THE EVOLUTION OF THE U.S. ARMY AVIATION DURING OPERATION ENDURING FREEDOM IN AFGHANISTAN

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

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by

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This study attempted to address "How did U.S. Army Aviation adapt itself to the harsh operational environment (OE) (terrain, weather and enemy) of Afghanistan during Operation Enduring Freedom (OEF)" The methodology consisted of a comparison of initial and current conditions of U.S. Army Aviation in terms of organization, doctrine, training and equipment. Interviews over the past ten years with OEF veteran pilots, the survey conducted by the author and archival documents were used to analyze the changes done by U.S. Army Aviation.
The findings concluded that the OE in Afghanistan adversely effected the capabilities and effectiveness of both aircraft and aircrews. In response to these effects, U.S. Army Aviation shifted its focus from deep attack to close combat support and trained pilots in order to meet the needs of the war on terror. It also evolved into a smaller, modular, adaptable, agile, deployable and logistically sustainable structure.
The threat in the future is expected to be similar to the current hybrid threat. Focusing on a singular threat, either conventional or irregular, cannot be an acceptable option for U.S. Army Aviation. To be successful in the future, it needs to maintain the capabilities it gained during OEF to address both threats. Additionally, U.S. Army Aviation should transform the current temporary form into permanent structure which would allow army aviation units to operate in different OEs.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE EVOLUTION OF THE U.S. ARMY AVIATION DURING OPERATION ENDURING FREEDOM IN AFGHANISTAN, by Major Bayram Baran, 100 pages.

This study attempted to address “How did U.S. Army Aviation adapt itself to the harsh operational environment (OE) (terrain, weather and enemy) of Afghanistan during Operation Enduring Freedom (OEF)” The methodology consisted of a comparison of initial and current conditions of U.S. Army Aviation in terms of organization, doctrine, training and equipment. Interviews over the past ten years with OEF veteran pilots, the survey conducted by the author and archival documents were used to analyze the changes done by U.S. Army Aviation.

The findings concluded that the OE in Afghanistan adversely effected the capabilities and effectiveness of both aircraft and aircrews. In response to these effects, U.S. Army Aviation shifted its focus from deep attack to close combat support and trained pilots in order to meet the needs of the war on terror. It also evolved into a smaller, modular, adaptable, agile, deployable and logistically sustainable structure.

The threat in the future is expected to be similar to the current hybrid threat. Focusing on a singular threat, either conventional or irregular, cannot be an acceptable option for U.S. Army Aviation. To be successful in the future, it needs to maintain the capabilities it gained during OEF to address both threats. Additionally, U.S. Army Aviation should transform the current temporary form into permanent structure which would allow army aviation units to operate in different OEs.

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DEDICATION

To my elder brother Captain Adil ERDOGAN and to those heroes who lost their lives in the grievous helicopter accident in March 16, 2012 in Kabul, Afghanistan. You will never be forgotten.

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ACRONYMS

A2C2	Army Airspace Command Control
ACR	Armored Cavalry Regiment
ACS	Armored Cavalry Squadron
ADA	Air Defense Artillery
ADAM	Air Defense and Airspace Management
AGI	Air Ground Integration
AI	Air Interdiction
AO	Area of Operation
AVCATT	Aviation Combined Arms Tactical Trainer
AW	Army Warrior
BAE	Brigade Aviation Element
BAO	Brigade Aviation Officer
BCT	Brigade Combat Team
CAB	Combat Aviation Brigade
CCA	Close Combat Attack
CMWS	Common Missile Warning System
COL	Colonel
DOCC	Deep Operation Coordination Cell
EAC	Echelon Above Corps
EAL	Sea, Air, Land
ETL	Effective Translational Lift
FLIR	Forward Looking Infrared
FLOT	Forward Line of Own Troops

FM	Field Manual
FORSCOM	United States Army Forces Command
HAATS	High-Altitude Army National Guard Aviation Training Site
HAMETS	High-Altitude Mountain Environmental Training Strategy
IA	Interdiction Attack
IGE	In Ground Effect
IRCM	Infra-red Guided Missile Countermeasure
JRTC	Joint Readiness Training Center
LNO	Liaison Officer
LTC	Lieutenant Colonel
LZ	Landing Zone
MAJ	Major
MANPADS	Man Portable Air Defense Systems
MATF	Multi-Functional Aviation Task Force
MDMP	Military Decision Making Process
MEDEVAC	Medical Evacuation
METT-TC	Mission, Enemy, Terrain and Weather, Troops and Support Available, Time Available, and Civil Considerations
MFAB	Multi-Functional Aviation Brigade
MTOE	Modified Table of Organization & Equipment
NCO	Non-commissioned Officer
NOE	Nap-of-the-Earth
NTC	National Training Center
NVD	Night Vision Device
NVG	Night Vision Goggle

OE	Operational Environment
OEF	Operation Enduring Freedom
OGE	Out Ground Effect
OPCON	Operational Control
RC	Regional Command
SAM	Surface to Air Missile
SOP	Standard Operating Procedures
TACOPS	Tactical Operations
TC	Training Circular
TF	Task Force
TOC	Tactical Operation Center
TTP	Tactics, Techniques, and Procedures
U.S.	United States
UHF	Ultra High Frequency
VHF	Very High Frequency

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CHAPTER 1

INTRODUCTION

Operation Enduring Freedom

The attacks on New York and Washington D.C. on September 11, 2001 significantly impacted America in many ways. Above all, the safety perception of American society changed dramatically. Suddenly, national security and defense became first priority. New governmental organizations; such as the Department of Homeland Security, the Transportation Security Administration, and the National Counterterrorism Center; were created soon after the attacks in order to keep the country safe. The Patriot Act, Aviation and Transportation Security Act, and Enhanced Border Security and Visa Entry Reform Act are some of the 9/11 related legislation which were approved and signed into law. The budgets for defense and for homeland security related agencies increased considerably.

The longest-running war in U.S. history, Operation Enduring Freedom (OEF), officially began on October 7, 2001 shortly after these catastrophic attacks. President George W. Bush announced the preliminary military objectives of OEF as "the destruction of terrorist training camps and infrastructure within Afghanistan, the capture of al Qaeda leaders, and the cessation of terrorist activities in Afghanistan."[1] The 13-year war officially ended on December 28, 2014, once these objectives were achieved. Even though most of the troops redeployed, U.S. military personnel are still in Afghanistan to

[1] GlobalSecurity, "Operation Enduring Freedom–Afghanistan," last modified May 7, 2011, accessed March 9, 2015, htttp://www.globalsecurity.org/military/ops/enduring-freedom-intro.htm.

assist and advise the Afghan Army under an operation with a new name, "Operation Freedom's Sentinel."[2]

During OEF, U.S. Army Aviation played an important role in Afghanistan. The harsh operational environment (OE) of Afghanistan increased the need for army aviation. However, the terrain with rugged mountains and deserts, the extreme hot and cold climate, and the threat of a dispersed enemy adversely affected army aviation operations. Some of the capabilities of army aviation units, such as maneuver and lift, were considerably limited by this tough environment. In order to be successful, U.S. Army Aviation adapted to the new conditions by changing its organization, doctrine, training, and equipment.

Limitations

The survey conducted in this study is limited to the number of pilots who deployed to Afghanistan between 2001 and 2014 and who volunteered from the AY2015 Command and General Staff College (CGSC) students and the CGSC faculty.

Secondly, only unclassified data is used in this study, as this is sufficient to answer the question proposed in this thesis. The other reason for not using classified data is to make the results of this study this study more easily accessible for the public.

Delimitations

This research focuses on OEF in Afghanistan between 2001 and 2014. In this study, only U.S. Army Aviation is taken into consideration. U.S. Air Force, Navy,

[2] Andrew Tilghman, "Afghanistan War Officially Ends," *Military Times*, December 30, 2014, accessed March 9, 2015, http://www.militarytimes.com/story/military/pentagon/2014/12/29/afghanistan-war-officially-ends/21004589/.

Marine, and Special Operations Forces air assets, and coalition partners' army aviation units are not discussed in this study.

This study focuses primarily on organization, doctrine, training and equipment. Hence, this research does not address other activities such as logistics and intelligence.

This research is limited to Afghanistan. It does not address Operation Iraqi Freedom or other operations conducted at the same time or under the name of Operation Enduring Freedom in other areas.

CHAPTER 2

LITERATURE REVIEW

> A military helicopter was shot down in eastern Afghanistan, killing 31 U.S. special operation troops, most of them from the elite Navy SEALs unit that killed al-Qaida leader Osama bin Laden, along with seven Afghan commandos. With its steep mountain ranges, providing shelter for militants armed with rocket-propelled grenade launchers, eastern Afghanistan is hazardous terrain for military aircraft.
>
> — Solomon Moore, *Spartanburg Herald*

Operational Environment of Afghanistan

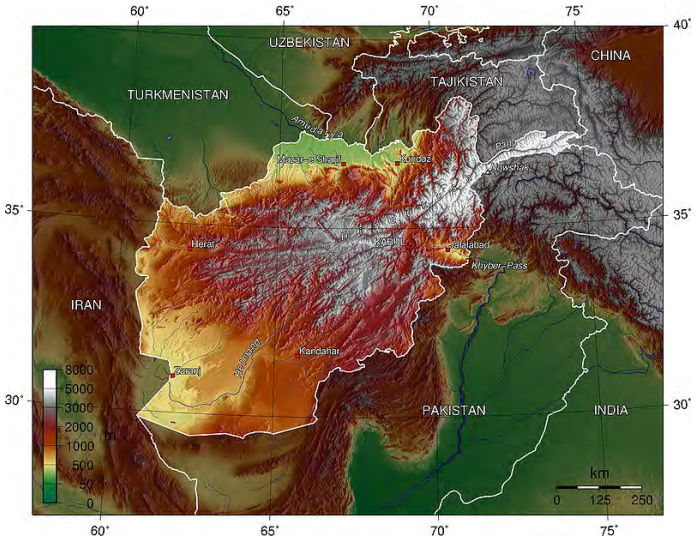

Figure 1. Topographic Map of Afghanistan

Source: Wikipedia, "Geography of Afghanistan," accessed March 7, 2015, http://en.wikipedia.org/wiki/Geography_of_Afghanistan.

This section briefly describes three parameters of the operational environment (OE) of Afghanistan: terrain, weather, and enemy.

Terrain

South and Central Asia, where Afghanistan is located, is considered one of the most mountainous areas in the world. In his monograph named "Mountain and Cold Weather Warfighting: Critical Capability for the 21st Century", Lieutenant Colonel (LTC) Scott W. Pierce describes South and Central Asia as follows: "weather and terrain combinations, low temperatures, high altitudes, deep snow, steep slopes, dramatic relief and complex compartmented terrain."[3] However, Afghanistan consists of several terrain structures. In his book named *Afghanistan Cave Complexes 1979-2004*, Mir Bahmanyar categorizes Afghanistan into three basic geographical regions: The Northern Plains, The Central Highlands and The Southwestern Plateau. The Northern Plains, whose average elevation is 2,000 feet above the sea level, has fertile soil, mountainous plateaus and rolling hills. With approximately 25,000 feet elevations, the Central Highlands comprises the largest and the most rugged part of Afghanistan. The Southern Plateau, with elevation ranges between 500 feet and 20,000 feet, mainly includes arid desert, hills and low mountains with minimal vegetation and water sources.[4]

Weather

As with the terrain structure, Afghanistan's climate varies from region to region. While a dry and desert climate exists in the southwest with just two inches precipitation

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[3] Scott W. Pierce, "Mountain and Cold Weather Warfighting: Critical Capability for the 21st Century" (Monograph, School of Advanced Military Studies, 2008), 40.

[4] Mir Bahmanyar, *Afghanistan Cave Complexes 1979-2004* (Northants: Osprey Publishing, 2004), 5.

annually, the average amount of precipitation in the northeast is 39.06 inches.[5] An extreme range of temperatures within a limited period is a significant feature of Afghanistan's climate. While severe cold [−24 °C (−11 °F)] occurs for several days constantly in winter, temperatures of 45–50 °C (113–122 °F) in shade is usually witnessed in summer seasons. Snow accumulation is persistent for months in most parts of the country. In the hot season, dust storms and fiery winds are frequently seen in some sectors.[6] Sometimes, extraordinary weather conditions occur such as 30-knot wind almost every day about noon time for 120 days.[7]

Enemy

Al Qaeda and Taliban fighters who are familiar with the terrain and weather of Afghanistan generally hide in natural and manmade complex caves formed on high mountains and deep valleys. Ideologically motivated Al Qaeda and Taliban forces are mainly equipped with small arms, machine guns, and rocket-propelled grenades (RPG). They rarely use surface to air missiles (SAM) in Afghanistan.

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[5] Andrew P. Betson, "Nothing is Simple in Afghanistan: The Principles of Sustainment and Logistics in Alexander's Shadow," *Military Review* (September-October 2012), accessed March 9, 2015, http://usacac.army.mil/CAC2/MilitaryReview/ Archives/English/MilitaryReview_20121031_art010.pdf.

[6] Wikipedia, "Geography of Afghanistan," last updated May18, 2015, accessed May 22, 2015, http://en.wikipedia.org/ wiki/Geography_of_Afghanistan.

[7] James Dimon, Interview by John McCool, January 23, 2006, Operational Leadership Experiences Project, Combat Studies Institute, 7.

Effects on Army Aviation

Like many others, Major (MAJ) James Dimon, U.S. Army Aviation pilot, describes the Afghanistan environment as the toughest one for Army aviation, because it possesses both desert and high mountains which limit aircraft and aircrew capabilities. As MAJ Dimon stated in his interview, there are two different types of terrain in Afghanistan which significantly affect Army aviation operations; mountains and desert.[8]

Mountains

The mountains, which cover around two thirds of Afghanistan's geography, have both advantages and disadvantages for army aviation operations. The major advantages of the mountainous areas are terrain-masking and radar and visual acquisition avoidance. However, they usually present critical difficulties for aviators. Field Manuel (FM) 1-100, *Army Aviation Operations,* enumerates the difficulties of mountainous terrain for army aviation as limited maneuverability, engagement areas, and aircraft lift capability. According to FM 1-100, rapidly changing weather conditions and aircraft icing are the other common issues that army aviation units face.[9] These difficulties basically stem from two key features of mountains: high altitude and a compartmented and complex terrain structure which are usually accompanied by extreme weather conditions.

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[8] Ibid.

[9] Department of the Army, Field Manual (FM) 1-100, *Army Aviation Operations* (Washington, DC: Department of the Army, 2007), 3-1, 3-2.

High Altitude

Many pilots point out that high altitude was the first and foremost significant root cause of aviators' problems in Afghanistan. Limited aircraft lift capability was one of the main consequences of high elevation. Most of the time, the altitude of the take-off and landing zones and the operation areas were the determiners for allowable gross weight. MAJ Jennifer Gruber, a UH-60 pilot who served in Afghanistan during 2003 and 2004, highlights that the high altitude significantly limited the number of passengers and the pounds of cargo they transported in UH-60s.[10] Similarly, in his interview, MAJ Randy James, a U.S. attack helicopter pilot who served in Afghanistan in 2002 and 2003, reports that sometimes Apaches could not hover even at Bagram Airfield, because of the hot weather and heavy aircraft.[11] Decreasing lift capability of the helicopters resulted in some changes in preferences of the aircraft types for missions. For instance, as Dr. James W. Williams, writer of *A History of Army Aviation*, states that due to its higher performance in high altitude conditions, Chinooks have been used as the primary air assault platforms instead of Blackhawks.[12]

In operations, conducted by U.S. Army Aviation Units in Afghanistan, high altitude significantly reduced the support capability of attack helicopters, as well. In his study, called "Will U.S. Army Attack Aviation Be a Relative Combat Multiplier in

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[10] Jennifer Gruber, Interview by Lessard Laurence, May 27, 2009, Operational Leadership Experiences Project, Combat Studies Institute, 9.

[11] Randy James, Interview by Jessica Trussoni, October 8, 2008, Operational Leadership Experiences Project, Combat Studies Institute, 8.

[12] James W. Williams, *A History of Army Aviation* (Lincoln: iUniverse, 2005), 380.

Future Conflicts," MAJ Douglas L. Brockhard Jr. articulates that, owing to the lack of power in high elevations, Apaches could not manage to fire against targets from the hover position, as the pilots had been trained for. They had to learn how to make running fire engagements.[13]

Mountainous regions generally include cold weather features such as high winds, snowfall and cold temperatures. Forces operating in cold weather and mountainous areas often face unsuitable landing zones (LZ), due to high winds and poor visibility from rain, snow and fog. LTC Scott W. Pierce mentions challenges such as white-out from snow stirred up by rotor-wash, belly-landing in deep snow, and the difficulties of maintaining aircraft, particularly in this environment.[14]

In addition to its impact on the capabilities of army aviation aircraft, high mountains adversely affect human physiology, as well. Since the atmospheric pressure declines inversely to altitude, less oxygen is available in higher elevations. According to the U.S. Federal Aviation Administration, the human body is able to adjust to operate between sea level and 12,500 feet altitude which is called the physiological efficient zone. However, if the human body is exposed too long to the upper layer of this zone, some complaints such as shortness of breath, dizziness, headaches and fatigue may arise.

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[13] Douglas L. Brockhard Jr., "Will U.S. Army Attack Aviation Be a Relative Combat Multiplier in Future Conflicts?" (Master's Thesis, US Army Command and General Staff College, Ft. Leavenworth, 2004), 26.

[14] Pierce, 14.

Between 12,500 feet and 50,000 feet, when in the physiological deficient zone, major physiological problems such as hypoxia and decompression sickness are seen.[15]

Although human physiological adaptation is possible up to altitudes of 18,000 feet, above 18,000 feet, acclimatization is definitely required. FM 3-97.6, *Mountain Operations*, explains the illnesses and injuries in detail which occur at high altitudes.[16]

Compartmented and Complex Feature

The compartmented and complex feature of mountainous terrain is the other major root cause of the aviators' problems. It limits the number of valleys that helicopters can fly through at low altitude. Thus, the aircraft restricted to certain valleys by the terrain, are subject to canalization and become vulnerable to ground fires such as small arms, machine guns, RPGs and surface-to-air missiles. MAJ Randy James, U.S. Army Aviator served in Afghanistan in 2002 and 2003, is one of the pilots who reported in their interview that they usually followed the same flight paths dictated by valleys due to the high mountains around them.[17]

The compartmented and complex terrain is suitable for enemy to hide himself and his weapon systems. The ridges and draws of mountain slopes cover and conceal enemy. In this kind of terrain, aircrews may be able to see the enemy only at short distances and

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[15] Federal Aviation Administration, "Aviation Physiology," accessed March 7, 2015, https://www.faa.gov/pilots/training/airman_education/media/IntroAviationPhys.pdf.

[16] Department of the Army, Field Manual (FM) 3-97.6, *Mountain Operations* (Washington, DC: Department of the Army, 2000), A-1, A-4.

[17] James, 8.

for only a short time. The effectiveness of close air support degrades significantly because the pilots have difficulty spotting targets and friendly troops on the ground.

Terrain compartmentation in the mountains also disrupts communications and shortens radio ranges. Most of the time, it becomes difficult to benefit from the radio communication systems which depend on line of sight such as very high frequency (VHF) and ultra-high frequency (UHF) radio communications.[18]

Desert

The Afghanistan desert presents other unique challenges. Extreme heat and dust are the best terms to describe the desert environment. Like mountainous terrain, the desert also possesses advantages and disadvantages for army aviation operations. According to FM 1-100, an important advantage of desert terrain is the ability to engage enemy from long distances. At the same time, the open terrain also makes aircraft more vulnerable to enemy observation and ground fires.[19]

One of the other effects of the desert on army aviation mentioned in FM 1-100 is that dense dust may result in "brownout" during landing. While the pilots who served in mountainous conditions indicated that high altitude was the main challenge in Afghanistan, the others who flew in the desert environment describe dust as the main challenge. In their interviews, both LTC Todd Conyers[20] and MAJ Jennifer Gruber[21],

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[18] Pierce, 21.

[19] Department of the Army, FM 1-100, *Army Aviation Operations*, 3-2, 3-3.

[20] Todd Conyers, Interview by Lessard Laurence, March 15, 2007, Operational Leadership Experiences Project, Combat Studies Institute, 7.

[21] Gruber, 4.

U.S. army aviation pilots who served in Afghanistan, describe dust landing as an significant issue and very dangerous. Moreover, when dust landing combines with night vision google flight, the situation becomes worse for aviators. Another major disadvantage of the desert environment is decreased lift capability due to hot weather.

Adaptation of the U.S. Army Aviation to the OE of Afghanistan

Operation Enduring Freedom led to significant changes in U.S. Army Aviation in parallel with broad changes in the U.S. Army. There is a consensus among authors that army aviation units undertook major changes in organization, doctrine, training and equipment to adapt to the environment.

Organization

As regards organization, U.S. Army Aviation transformed into more modular, joint, capability-based, deployable, and sustainable organizations in order to meet the needs of the war on terror in Afghanistan and Iraq. There are several written documents concerning the history of U.S. Army Aviation. Dr. James W. Williams' book named *A History of Army Aviation* is one of the most relevant studies about the changes of U.S. Army Aviation. Although he primarily focuses on the changes undertaken before the war on terror, he presents notably detailed information concerning the beginning years of OEF as well. Williams stresses that conflict episodes led to transformation during OEF, as they happened in history.

Another important study about the organizational transformation in U.S. Army Aviation is the monograph written by MAJ David Law in 2012. In this study, Law examines and compares the organizational changes in U.S. Army Aviation from 1950 to

2010 by 10-year increments. He aims to determine the factors which led to those organizational changes in U.S. Army Aviation.[22]

According to Law's findings concerning organizational changes in U.S. Army Aviation between 2000 and 2010 primarily more capable, deployable, and sustainable forces; the multi-functional battalions; were created. Then, aviation brigades first transformed into multi-functional aviation brigades and later transformed into Combat Aviation Brigades (CAB).[23] In accordance with the transformation, the RAH-66 Comanche program was cancelled due to the changing nature of needs.

Additionally, Law analyzes five variables which are conflict episodes, doctrine, technology, budget constraints, and existential threats (Cold War) in order to reach the major factor that led to organizational changes. According to Law, the primary factor which forced organizational changes during OEF was conflict episodes. Doctrine and budget constraints are secondary factors which indirectly led to changes in this period.[24]

LTC David Bresser, a U.S. Army Aviation pilot who served in Afghanistan twice, supports Law's findings in his interview. He reports that his brigade and battalion reorganized into "hybrid" (multi-functional) units right before his deployment in 2009. He notes that each of the hybrid battalions of the hybrid brigades included Blackhawks,

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[22] David Law, "United States Army Aviation Organizational Changes" (Monograph, School of Advanced Military Studies, 2012), iv.

[23] Ibid., 47.

[24] Ibid., 52.

Chinooks, Apaches, and medical evacuation (MEDEVAC) helicopters allowing them to conduct a range of missions.[25]

Doctrine

COL Russell Stinger, in his research project named "Army Aviation–Back to its Roots", raised several concerns about the position of the army aviation branch in the field, especially the attack helicopters. He questions whether army aviation should support ground forces by providing close fire as it was in the past or separate from the ground forces and focus on deep attack. He concludes that army aviation remembered and started playing its original role in the field in Afghanistan and returned to its roots: close support of ground troops. According to Stinger, army aviation's mission priority evolved from deep attack to close support of ground forces during OEF. In parallel with this change, the aviation brigades which were tasked with deep attacks at the corps level were eliminated.[26]

COL Stinger also points out that close coordination needs between ground forces and air units arose when they operated together. A brigade aviation element (BAE) cell was added to each brigade combat team (BCT) for the purpose of providing the expertise to the ground commander and improving the relationships for effective air-ground

[25] David Bresser, Interview by Michael Mestan, January 30, 2014, Operational Leadership Experiences Project, Combat Studies Institute, 4.

[26] Russell Stinger, "Army Aviation–Back to its Roots" (Monograph, School of Advanced Military Studies, 2009), 30.

integration (AGI).[27] The more the ground units and the aviators understood each other, the more effective their missions became.

MAJ Douglas L. Brockhard Jr. states that the attack aviation pilots were mainly trained for engaging targets in the last one third of the maximum effective range of their weapon systems until Operation Anaconda. In Operation Anaconda, Al Qaeda and Taliban employed high volumes of small arms and machine gun fires as well as RPGs. When conducting close combat attack (CCA) under intense enemy small arms fire, due to the close distance between friendly and enemy forces, the attack aviation pilots realized that they had to fly into enemy small arms range in order to avoid fratricide.[28] "History has repetitively demonstrated that attack helicopters are susceptible to these primitive threats."[29] All of the eight attack helicopters used in Operation Anaconda took heavy small-arms fire. Two of them were heavily damaged by RPG hits to the tail and nose sections.[30] Even though the aircraft received damage during the operation, they successfully accomplished their mission. "The AH-64 was the weapon that changed the face of the battle."[31]

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[27] Ibid.

[28] Brockhard, 25.

[29] Ibid., 37.

[30] Christian F. M. Liles and Christopher Bolkcom, *Military Helicopter Modernization: Background and Issues for Congress* (Washington, DC: CRS Report for Congress, 2004), 33.

[31] David E. Johnson, *Learning Large Lessons. The Evolving Roles of Ground Power and Air Power in the Post-Cold War Era* (Santa Monica, CA: RAND Corporation, 2006), 102.

Training

At the very beginning of OEF, the training level of aircrews was not sufficient to operate in this unusual OE. However, the ones who were deployed to Afghanistan later, learned from their predecessors' experiences. They were trained on operating in these challenging mountainous and desert conditions in order to meet the needs of the fight in Afghanistan. There is controversy among aircrews about the benefit of these training programs. Some pilots believe these pre-deployment training programs were not useful[32] but many aviators believe that they were beneficial in terms of preventing potential accidents.[33]

Equipment

The RAH-66 Comanche Armed Reconnaissance Program was cancelled in 2004 due to budget constraints,[34] a changing threat environment, and the evolving nature of future requirements.[35] After the cancellation, $39 billion dollars[36] which had been allocated for the RAH-66 Comanche Program, was used for other aviation programs such as upgrading the other aircraft and acquiring more helicopters.[37]

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[32] Michael Shenk, Interview by John McCool, October 28, 2005, Operational Leadership Experiences Project, Combat Studies Institute, 3.

[33] David Francis, Interview by Chris Ives, October 20, 2006, Operational Leadership Experiences Project, Combat Studies Institute, 5.

[34] Law, 8.

[35] James R. Macklin, Jr., "Air Power and Counterinsurgency: A Strategic Study In Efficiency" (Strategy Research Project, U.S. Army War College, 2010), 18.

[36] Ibid.

[37] Williams, 328.

During OEF, aircraft were upgraded several times in order to make them more capable, much faster and more powerful. In addition to helicopters, some other equipment such as aviation life support equipment (ALSE) and aircraft survivability equipment (ASE) were invented or upgraded, as well.

Literature Gap

There are several relevant sources regarding the topic of Army Aviation in OEF, however, very few books present the changes together in terms of organization, doctrine, training, and equipment. For instance, Law's research named "United States Army Aviation Organizational Changes" examines only organizational changes in army aviation and their reasons. Similarly, MAJ Darren W. Buss' thesis named "Evolution of Army Attack Aviation: A Chaotic Coupled Pendulums Analogy"[38] and Colonel Russell Stinger's research project named "Army Aviation – Back to its Roots"[39] are both merely focused on the evolution of army attack helicopters' roles on the battlefield.

Many studies scrutinize limited periods of OEF instead of focusing on the entire operation. Although Dr. Williams' book provides broad information on this topic, it just focuses on the beginning years (2001-2005) of OEF. There are also some works which only investigate particular operations conducted during OEF as case studies. For instance, *Operation Anaconda: America's First Major Battle in Afghanistan*, written by Lester W.

[38] Darren W. Buss, "Evolution of Army Attack Aviation: A Chaotic Coupled Pendulums Analogy" (Master's Thesis, US Army Command and General Staff College, 2013).

[39] Stinger.

Grau and Dodge Billingsley is a historical document which gives detailed information specifically about Operation Anaconda.

The gap in literature for this topic is the lack of a comprehensive study which focuses on the entire OEF and the parameters such as organization, doctrine, training, and equipment together. This thesis covers the changes undertaken by U.S. Army Aviation in order to adapt to this environment.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction and Purpose

This research examines Operation Enduring Freedom (OEF) and focuses on adaptation of the U.S. Army Aviation units to the operational environment (OE). This research study is an in-depth examination of the effects of the harsh OE of Afghanistan on U.S. Army Aviation operations, difficulties faced by the U.S. Army Aviation units, and adjustments undertaken by the Army Aviation units in order to cope with these issues in Afghanistan. The ultimate goal is to compile, analyze and identify the methods used by the U.S. Army Aviation to adapt to the OE in Afghanistan and to provide guidance for the units who will serve in similar areas in the future.

Research Questions

Primary Research Question

How did U.S. Army Aviation adapt to the harsh operational environment (terrain, weather and enemy) of Afghanistan during OEF?

Secondary Research Questions

1. How did the operational environment (weather, terrain and enemy) affect U.S. Army Aviation in Afghanistan during OEF?

2. What did U.S. Army Aviation do in order to adapt to the operational environment of Afghanistan during OEF?

Research Design

This is a mixed research methodology which includes qualitative and quantitative methods. This study took advantage of qualitative research to explore U.S. Army Aviation organization, doctrine, training, and equipment prior to and after OEF. This allowed a comprehensive investigation of a topic of interest with interviews, surveys, and archival documents. This comparative study was used to determine answers to the secondary research questions, and ultimately the primary question. This comparison process will allow readers to understand the evolution of the U.S. Army Aviation in Afghanistan.

In addition to the qualitative research method, quantitative research method was also used in this study. The survey research model was used in order to obtain primary source data and to add depth to the study directly from participants with OEF experience.

Survey Design

The CGSC Quality Assurance Office allows researchers to utilize the Inquisite Survey Builder, an online survey package, to build a survey. The Inquisite Survey Builder, a licensed software, was used to design the survey used in this study. The CGSC Quality Assurance Office also provided assistance in administrating and publishing the survey. The CGSC Quality Assurance Office also provided confidentiality and security of the survey. They maintain the survey in a secure server for a minimum of three years.

The survey, "Adaptation of the U.S. Army Aviation Units to Afghanistan OE," is comprised of six focus areas:

1. Demographics and Combat Deployments - Service Branch, Number and Years of Deployments to Afghanistan during OEF;

2. Preparedness Status to Afghanistan and Pre-deployment Activities;

3. Effects of OE on U.S. Army Aviation Operations in Afghanistan;

4. Adjustments Undertaken by U.S. Army Aviation in Response to the Effects of the OE;

5. Adjustments Undertaken by Enemy in Response to U.S. Army Aviation Operations;

6. Recommendations for Other Army Aviation Units Deploying to Similar Environment.

Questions in this survey were prepared by author. The survey included both qualitative and quantitative questions. Except for the section related to Demographics and Combat Deployments data, an open-ended box was placed at the end of each focus area to give the participants an opportunity to provide personal comments and recommendations concerning the related area.

An online survey technique and a web-based design were used to conduct the survey. Participants received the survey through a direct email sent by author to their official email addresses. The email contained a link which enabled participants to access the survey. Since the web-based survey inherently provided confidentiality, the researcher assumed that the participants would be objective and honest in their answers and comments.

This study utilized the convenience sampling strategy contained in the survey. This strategy is also referred to as accidental or availability sampling because it is based

on the available subjects, such as officers who are close at hand or easily accessible.[40] The population of this survey was selected from the faculty and military officers attending the residential Command and General Staff Officers' Course (CGSOC) of the Command and General Staff School (CGSS) located at Fort Leavenworth, Kansas. This population consisted of army military officers who were mostly majors. However, the population also included a small number of captains and/or lieutenant colonels. The demographics were consistent with those seen Army-wide with respect to age, gender and racial demographics of mainly field grade officers. Only army aviation and infantry branch participants were accepted as eligible to take the survey. The officers from other services (Air Force, Marine, Navy, or Coast Guard), and Special Operations and international military officers were excluded.

Invitations were emailed to 653 Command and General Staff Officer's Course faculty and U.S. military students attending the 2015 academic year, regardless of their service branch and OEF experience. The initial number of respondents to the emailed survey was 53, a response rate of eight percent. However, 38 of the 53 respondents were not eligible to take the survey because of the branch and OEF experience requirements, which disqualified them from participating. Thus, only 15 respondents were eligible to continue with the survey. Further, inspection of the data found two cases in which the participants completed only the demographics questions and discontinued their participation. Eventually, this resulted in 13 fully qualified respondents for data analysis providing a final response rate of 2 percent.

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[40] Bruce L. Berg and Howard Lune, *Qualitative Research Methods for the Social Sciences* (Boston, MA: Pearson, 2004), 35.

The branches represented in the 13 participants were seven army aviation and six infantry officers (table 1.)

Table 1. Branch of Service Frequencies			
	Frequency	Percent	Cumulative Percent
Army Aviation	7	53.8	53.8
Infantry	6	46.2	100.0
Total	13	100.0	

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Tables 2 and 3 provide participants' OEF deployment and frequency information.

Table 2. Deployment Frequencies (Army Aviation)			
	Frequency	Percent	Cumulative Percent
Once	3	37.5	37.5
Multiple Times	5	62.5	100.0
Total	8	100.0	

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Table 3. Deployment Frequencies (Infantry)			
	Frequency	Percent	Cumulative Percent
Once	2	28.5	28.5
Multiple Times	5	71.5	100.0
Total	7	100.0	

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

None of the five army aviation branch participants who experienced multiple deployments were deployed to Afghanistan between 2002 and 2005. Only one of the three army aviation branch participants with only one deployment served in Afghanistan between 2002 and 2005. Similarly, two of the seven infantry branch participants were deployed to Afghanistan between 2002 and 2005.

Data Analysis

Data analysis began with organizing and preparing the data collected during initial research from resources such as books, monographs, and surveys. The data were noted and coded in regards to the topic; such as organization, and doctrine. Coding was utilized to generate categories of the major findings. Finally, the data was interpreted and analyzed. At this point, the focus point was "What did the U.S. Army Aviation do in order to adapt to the OE of Afghanistan?" The findings and the information collected from the literature and the survey are juxtaposed to make recommendations.

CHAPTER 4

ANALYSIS

> Don't try to make these ad hoc organizations; I'm going to take one from this post and this post and this post and put them together. Take the people that normally would work together. They have confidence. They have already worked out the kinks and are ready to go. They should have received all the same training, hit all the same gates, and went to the same combined training center (CTC). If you make all these things line up together then they are just ready to go and keep rolling along.
>
> — MAJ Randy James, Interview

In this chapter, the data gathered from literature, interviews and survey conducted by author regarding "U.S. army aviation's adaptation to operational environment (OE) of Afghanistan" is analyzed under the sections of organization, doctrine, training, and equipment. Moreover, the analysis compared initial conditions and the current conditions of army aviation units.

Organization

Multi-functional Aviation Brigades

US Army Aviation's capstone manual, Field Manual (FM) 1-100, *Army Aviation Operations,* provides broad information about the employment of army aviation on the battlefield. FM 1-100, published in 1997, was current when OEF started. According to FM 1-100, army aviation brigades were organized primarily for three echelons: division, corps, and above corps. In addition, armored cavalry regiments (ACR) and armored cavalry squadrons (ACS) were present at the corps and division levels, respectively. Even though echelons above corps (EAC) (theater) aviation brigades primarily supported corps

and division level tactical units, they could also conduct rear area security and reserve tasks.

Although corps and division aviation brigades had similar tasks, to some extent, corps army aviation brigades were primarily expected to shape the corps' area of operation (AO) by influencing follow on enemy forces. Since the division was accepted as the lowest level for combined arms, aviation units should be primarily assigned to, and employed by, at least division level.[41] However, aviation units could be placed under operational control of the other maneuver brigades for several tasks. The main idea of FM 1-100 was to explain how to utilize army aviation units as a whole or in as large of elements as possible to achieve operational objectives.

When OEF began, there were five types of army aviation brigades tailored to specific types of divisions: air assault, airborne, heavy, light and a tailored division deployed to Korea.[42] However, each type of army aviation force was different from others in terms of organization, as they had unique assets and capabilities. Each aviation brigade was primarily designed for a specific mission such as attack or assault. For example, the 101st Airborne Division based out of Fort Campbell, Kentucky, had two organic aviation brigades. The 101st Aviation Brigade, was designed, manned, equipped and trained for the attack mission, while the 159th Aviation Brigade was designed, manned, equipped and trained for the division's air assault operations.

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[41] Department of the Army, FM 1-100, *Army Aviation Operations*.

[42] Richard A. Martin, "Army Aviation and Unified Land Operations: Third Dimension of Land Warfare: Renewing Army Aviation's Role and Doctrine to Dominate the Third Dimension of Land Warfare" (Monograph, School of Advanced Military Studies, 2012), 35.

Task Force (TF) Talon was deployed to Afghanistan as the first conventional army aviation unit in 2002. Its mission was to support the 3rd Brigade Combat Team (BCT) from the 101st Airborne Division, TF Rakkasan. Since none of the aviation brigades had all types of aviation assets and capabilities at that time, TF Talon was formed by gathering several assets and capabilities from four separate aviation units; a CH-47 Chinook company, an AH-64A Apache company, a UH-60 Blackhawk company, three UH-60 MEDEVAC aircraft, an air traffic services section, and additional maintenance support all organized under a Chinook battalion headquarters.[43] TF Talon supported Operation Anaconda in March 2, 2002 by using twenty-four helicopters[44] including Chinook and Blackhawk aircraft from the 159th Aviation Brigade and Apache attack helicopters from its sister unit, the 101st Aviation Brigade.[45] At that time, it was uncommon for a Chinook Battalion to have command and control authority over the other types of aviation units especially attack helicopters.

Like many other aviation battalions deployed to Afghanistan before 2004, 2nd Battalion, 10th Aviation Regiment was built into a task force, as well. Before its deployment to Kandahar in 2003, 2nd Battalion, 10th Aviation Regiment was originally made up of only UH-60s. However, when it deployed to Afghanistan, it included

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[43] William A. Ryan, "Army Aviation: A Critical Member of the 21st Century Joint Team" (Monograph, Joint Forces Staff College, 2005).

[44] Lester W. Grau and Dodge Billingsley, *Operation Anaconda: America's First Major Battle in Afghanistan* (Lawrence, KS: University Press of Kansas, 2011), 96.

[45] Wikipedia, "159th Combat Aviation Brigade," last updated March 12, 2015, accessed May 9, 2015, http://en.wikipedia.org/wiki/159th_Combat_Aviation_Brigade.

Apaches, Chinooks, and MEDEVAC helicopters from different units in the Guard and Reserve all over the country.[46]

Gathering different units and personnel from several separate organizations resulted in some problems throughout the operations. From a tactical perspective, planning and execution of operations became more complicated and problematic. Each unit was assigned from separate organizations with unique climates and cultures. Further, they didn't have shared standard operation procedures (SOP)s and tactics, techniques, and procedures (TTP)s. They also did not have the opportunity to train together before deployment to Afghanistan. These problems were compounded by the creation of a new organization with different types of units and personnel under a battalion commander who was not familiar with the types of aircraft, thus causing mission command friction. In addition to tactical issues, logistics support emerged as a major problem as company-sized units were stationed at several isolated bases far from maintenance support and their internal logistics assets.

In parallel with the transformation of ground maneuver forces into BCTs after 2004, army aviation brigades were transformed into smaller, modular, adaptable, agile, deployable and logistically sustainable structures: multi-functional aviation brigades (MFAB). Each aviation brigade was designed to support up to five maneuver BCTs. They were expected to conduct all types of military operations, such as offense, defense, stability and defense support of civil authorities.

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[46] Darin Gaub, Interview Jenna Fike, December 3, 2009, Operational Leadership Experiences Project, Combat Studies Institute, 4.

The Army designed three primary types of MFAB; heavy, medium, and light aviation brigades. The only difference among these aviation brigades was the type and the number of attack helicopter battalions that they possessed. While a light aviation brigade had two OH-58 Kiowa Warrior squadrons and a heavy aviation brigade had two AH-64 Apache battalions, and a medium aviation brigade had one from each. Figure 2 depicts the organizational structure of the three main MFABs.

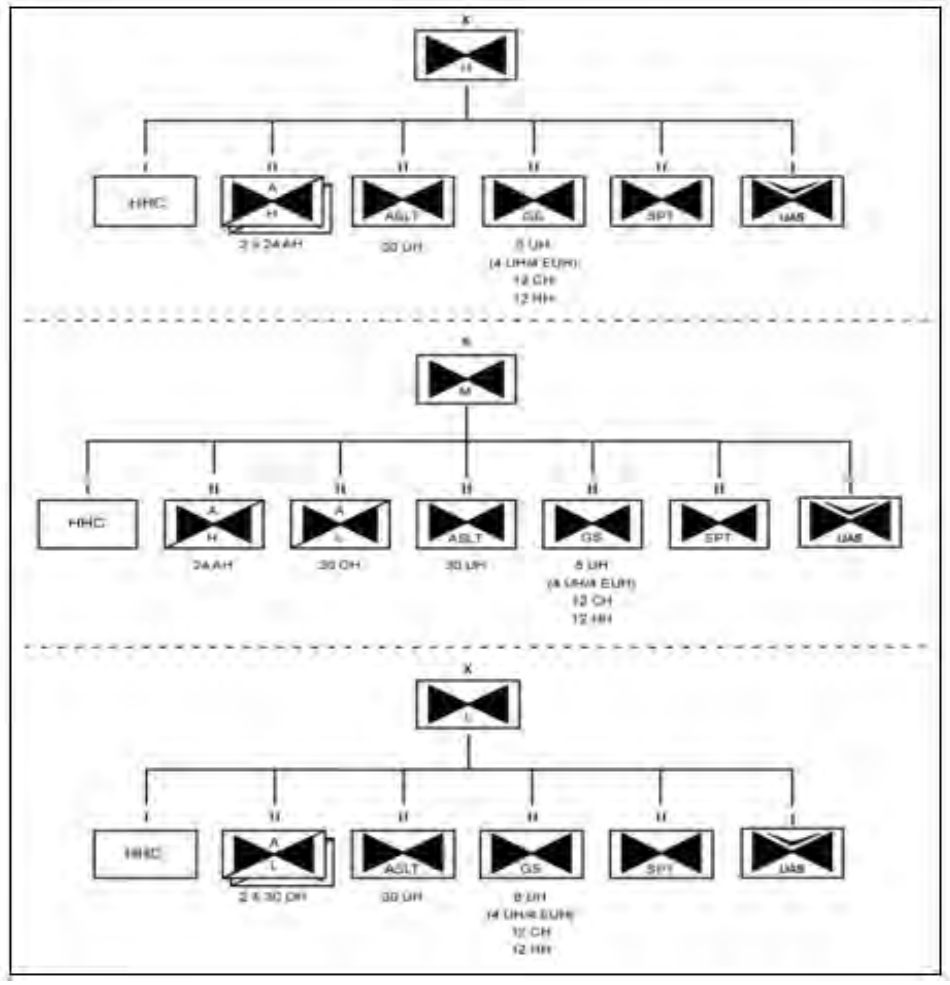

Figure 2. Heavy, medium, and light combat aviation brigades

Source: Department of the Army, Field Manual (FM) 3-04.111, *Aviation Brigades* (Washington, DC: Department of the Army, 2007), 1-5.

Standardized aviation battalions were created underneath those brigades. Whereas attack and assault aviation battalions were comprised of one type of company and one type of aircraft, general support aviation battalions contained several types of companies and aircraft. Rotary wing aviation battalions found in aviation brigades were:

1. An Attack Reconnaissance Squadron with 30 OH-58s.

2. An Attack Reconnaissance Battalion with 24 AH-64s.

3. An Assault Helicopter Battalion with 30 UH-60s.

4. A General Support Aviation Battalion with 4 EUH-60s, 4 UH-60s, 12 CH-47s, and 12 HH-60s.

All of the aviation companies underneath these multi-functional aviation brigades were standardized, as well. Depending on aircraft type, five types of company-level basic building blocks were designed. Each company was made up of only one type of aircraft. The company level blocks were:

1. An attack company with 8 AH-64 Apaches or 10 OH-58 Kiowas.

2. A general support company with 8 UH-60s Blackhawks.

3. An assault company with 10 UH-60s Blackhawks.

4. A heavy lift company with 12 CH-47 Chinooks.

5. A medical evacuation (MEDEVAC) company with 12 HH-60 aircraft.

As a result of this transformation, each aviation brigade had every type of aircraft organically. Former corps level units such as CH-47 heavy lift helicopters, air ambulance companies, and air traffic services companies were included under MFABs.[47] MFABs, later labelled as the Combat Aviation Brigades (CAB), turned into significant force

[47] Martin, 29.

multipliers when given heavy lift, MEDEVAC, and air traffic control capabilities. Thus, MFABs gained necessary capabilities to conduct full spectrum operations.

After the transformation, multi-functional aviation task forces (MATF) which were comprised of several companies with different capabilities such as attack, assault, MEDEVAC, and lift from the same aviation brigade were task-organized in direct support of BCTs, when needed. Furthermore, they usually co-located with their supported ground forces.

In 2008, the 101st CAB deployed two MATFs, which included several types of aircraft in direct support of ground maneuver BCTs.[48] Similarly, in 2009, 82d CAB's battalions reorganized into MATFs comprised of different types of aircrafts before it was deployed to Regional Command (RC) - South. Like other battalions of 82d CAB, 2d Battalion, traditionally an assault battalion, was constituted with assets from Blackhawk, Apache, MEDEVAC, and CH-47 units. The reorganized battalion, which had assault, attack, lift, and medical evacuation capabilities, was stationed in Zabul Province.[49]

The diverse task organization was the main reason aviation brigades effectively met their mission requirements in the OE of Afghanistan.[50] MATFs were highly successful in supporting ground forces by providing assault and attack helicopter capabilities. They became more responsive in a wide-ranging role and more effective. In addition, planning and execution were simpler when they had different capabilities within the same unit.

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[48] Stinger, 27.

[49] Bresser, 4.

[50] Martin, 28.

Furthermore, the MATFs were usually co-located with their supported ground forces to provide aviation support in the wide, nonlinear and distributed battlefield. There were several advantages of being co-located and closely tied to the supported BCT. First and foremost, both ground and army aviation units acknowledged and got used to each other. Training together and stationing at the same base led to effective air-ground integration and coordination. For instance; the pilots who served under the 101st Air Assault Division in Afghanistan were highly successful in integrating, coordinating and synchronizing their operations with supported ground units with which they co-located.[51] The co-located army aviation units could react to support ground forces quicker in case unexpected situations arose.

However, the new MATF resulted in some challenges in terms of mission command. Subordinate units' long-term command and support relationship with other BCTs resulted in difficulties for the MATF Commander in prioritizing efforts and tracking aircraft sustainment. In addition, building a strong team with pilots who came from different units took significant time.[52] Further, since MATFs did not co-locate with their parent brigade headquarters they had to rely on digital means to share information.[53]

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[51] Stinger, 22.

[52] Gaub, 10.

[53] Lee Robinson and Jesse Curry, "Reconnaissance, Communication, and Planning in the Decisive Action Fight," *Aviation Digest* 1, no. 3 (July-September 2013): 24-25.

Brigade Aviation Element

Army aviation assets were heavily engaged in Operation Anaconda, the first major battle in Afghanistan in 2002. One of the most significant lessons learned from Operation Anaconda was the need for air ground integration (AGI). Since the ground maneuver forces and aviation assets had not previously trained and operated together, both sides felt the necessity of close coordination in planning and execution. Moreover, they understood the importance of liaison officers (LNO)s, even if temporary, to integrate, coordinate and synchronize air ground operations.

In addition to temporary LNOs, the brigade aviation element (BAE), a permanent planning and coordination cell, was created in every BCT to meet the needs of effective AGI. The main purpose of the BAE was to incorporate army aviation into the ground commander's scheme of maneuver. The BAE was the link between the aviation tactical operation center (TOC) and the ground maneuver plan. The BAE is responsible for explaining the capabilities and limitations of army aviation and providing expertise and advice to the ground brigade commander. Even though the primary role of the BAE was to integrate army aviation into the BCT's ground maneuver plan, as a member of the ground brigade staff, it also helped the MATF to understand the ground maneuver plan by sharing information. Another function of the BAE was to contribute to army airspace command and control (A2C2) and air defense artillery (ADA) plans and executions.

Training Circular (TC) 1-400, *Brigade Aviation Element Handbook,* published in 2006, explained how the BAE operates and how it supports the BCT. The BAE was

planned, manned and equipped to operate 24 hours. It was also provided sufficient communication and transportation assets to operate in two different locations at a time.[54]

According to TC 1-400, the BAE consisted of six aviation branch personnel including two army aviation officers of the rank of major and captain. The organization of BAE in TC 1-400 is shown in table 4.

Table 4. BAE Organization

Title	Rank	Branch
Brigade Aviation Officer (BAO)	O4	Aviation
Brigade Aviation Element Plans Officer	O3	Aviation
Aviation Tactical Operations Officer	W3	Aviation
Aviation Operations Sergeant	E6	Aviation
Aviation Operations Sergeant	E6	Aviation
Aviation Operations Specialist	E4	Aviation

Source: Created by author, data from Department of the Army, Training Circular (TC) 1-400, *Brigade Aviation Element Handbook* (Washington, DC: Department of the Army, 2006), ix.

The modified table of organization & equipment (MTOE) of the BAE, which is currently in effect for BCTs, is different than the one listed in *Brigade Aviation Element Handbook.* According to the latest MTOE, the BAE is not a separate section. Instead, it is combined with air defense and airspace management (ADAM) and placed under the Fire Support/Protection section. Additionally, aviation branch personnel in the ADAM/BAE cell increased from six to seven. The current BAE structure is shown in table 5.

[54] Department of the Army, Training Circular (TC) 1-400, *Brigade Aviation Element Handbook* (Washington, DC: Department of the Army, 2006), ix.

Table 5. Current ADAM / BAE Organization		
Title	Grade	Branch
Aviation Officer	O4	Aviation
Air Defense Coordination/Management Officer	O3	Air Defense
Assistant Aviation Officer	O3	Aviation
Unmanned Aerial System Operations Officer	W4	Aviation
Tactical Operations Officer	W3	Aviation
C2 System Integrator	W2	Air Defense
Aviation Operations Sergeant	E6	Aviation
A2C2 Sergeant	E6	Aviation
Team Leader	E5	Air Defense
Battle System Operator	E4	Air Defense
Aviation Operations Specialist	E4	Aviation
Battle System Operator	E3	Air Defense

Source: Created by author, data from MTOE of 2nd BCT, 82nd Div; 2nd BCT, 10th Mtn Div; and 3rd BCT, 25th Div, May 3, 2015.

Joint Readiness Training Center (JRTC) Observers MAJ Matthew A. Hodges and CW3 Wesley M. Dohogn revealed several issues regarding today's BAE. Even though there are more aviators in the current MTOE, they identified the most common problem as the lack of personnel in BAE shops. TC 1-400 requires BAE manning for 24-hour operations. However, MAJ Hodges and CW3 Dohogn state that "nine out of ten shops have been manned at 50% strength or less." Although all BAEs have a Brigade Aviation Officer (BAO), they rarely have an aviation captain or warrant officer. BAEs are usually manned only with BAO, Aviation Operations Sergeant, and Aviation Operations Specialist.[55]

[55] Matthew A. Hodges and Wesley M. Dohogn, "Joint Readiness Training Center Observations of the Air Defense and Airspace Management/Brigade Aviation Element," *Aviation Digest* 1, no. 3 (July-September 2013):11-13.

Another issue is the lack of training of BAE personnel. According to the Fires Center of Excellence, the percentage of the BAE personnel who have attended the BAE course is less than 5 percent.[56] This would indicate most of the BAE personnel deployed to Afghanistan didn't have sufficient training and experience.

Moreover, in many BCTs, BAE personnel usually are given different jobs other than their own responsibilities. Working in different staff functions results in losing the experience and capability of the BAE personnel.[57]

Survey Results

The army aviation branch participants were requested to determine if army aviation units needed to reorganize in order to meet the needs of the operations in Afghanistan before deployment. Five of the seven participants (72 percent) reported that U.S. Army Aviation units reorganized before they were deployed to Afghanistan. One respondent (14 percent) felt the U.S. Army Aviation units did not need to reorganize before deployment. According to the demographics of the survey participants, only one out of the seven army aviation branch participants served in Afghanistan between 2002 and 2005 (table 6.) Since the number of the participants who were deployed to Afghanistan within the first groups is low, it is hard to consider that these results reflect the initial conditions. Instead, they mostly demonstrate pre-deployment efforts for the follow on deployments throughout OEF.

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[56] Ibid.

[57] Martin, 34.

Table 6. Pre-deployment Reorganization (Army Aviation)				
	Agree	Neutral	Disagree	Total
Before deployed to Afghanistan, the U.S. Army Aviation units did not need to reorganize in order to meet the needs of the operations in Afghanistan.	1	1	5	7
	14%	14%	72%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

As shown in table 7, all army aviation branch participants (100 percent) agreed that U.S. Army Aviation units changed their organization in response to the effects of the OE. On the other hand, table 8 depicts that only one of the six infantry officers (17 percent) agreed with the same statement. While half of them (50 percent) marked neutral, two of them (33 percent) reported that they disagree with this opinion. According to these results, there is no correlation between the army aviation responses and infantry responses. The reason for this discrepancy may be the inadequate information of infantry participants about army aviation units.

Table 7. Organizational Changes (Army Aviation)				
	Agree	Neutral	Disagree	Total
In response to the effects of the OE, the U.S. Army Aviation units changed their organization.	7	0	0	7
	100%	0%	0%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Table 8. Organizational Changes (Infantry)				
	Agree	Neutral	Disagree	Total
In response to the effects of the OE, the U.S. Army Aviation units changed their organization.	1	3	2	6
	17%	50%	33%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Participants were also provided several open-ended boxes to report their opinions, comments and recommendations concerning organization. The respondents strongly emphasized that they task-organized army aviation units into TFs to meet the needs of operations in Afghanistan. However, one of the army aviation officers stated that task-organizing just before deployment gave them little chance to succeed. Another army aviation officer reported that today's current MTOE does not meet the needs to operate as a MATF.

One of the officers recommended that the temporary TFs created to meet the needs of the deployment should be permanent, even during peace time. One participant suggested to "use complete units under organic commands to best use aviation and reduce risks."

Summary

During OEF, the two most significant organizational changes were the creation of CABs and BAEs. Additionally, co-locating the MATFs with their supported ground forces was also important.

Army aviation units were transformed into more smaller, modular, adaptable, agile, deployable and logistically sustainable structures to meet the needs of war on terror. CABs were created as the standard army aviation organizations. Several capabilities such as attack, assault, lift and MEDEVAC were gathered under them. CABs, which were capable of conducting full spectrum operations, turned into force multipliers. MATFs were formed under CABs to co-locate and provide robust aviation support to BCTs on the wide, nonlinear and distributed battlefield. Today, in spite of many pitfalls of the CABs and MATFs, interviews with pilots who served in Afghanistan and the survey results as well as literature indicate that they are considerably beneficial.

The army and the army aviation understood the importance of the AGI in the early days of OEF. The AGI absence was remedied with the BAE, comprised of seven aviators. However, today, it is hard to say that this organization can achieve its goal with limited personnel, training and experience. If close and constant coordination, integration and synchronization of air and ground operations are expected, sufficient aviators should be assigned to those positions. In addition, they should be trained properly and given an opportunity to do their own job.

Doctrine

Deep Operation–Close Combat Operation

Air Land Battle doctrine was introduced by FM 100-5, *Operations*, in 1982. FM 100-5 presented the deep attack tactics concept to delay an enemy's second echelon armored, mechanized and artillery forces.[58] In this doctrine, attack helicopter units were

[58] Department of the Army, Field Manual (FM) 100-5, *Operations* (Washington, DC: Department of the Army, 1982).

accepted as one of the assets at corps and division level to shape future operations. They were expected to cross the forward line of own troops (FLOT) and advance 80-100 kilometer behind the enemy lines to prevent the enemy from enforcing the first echelon forces.

Operation Desert Storm validated the deliberate deep attack tactics in 1991. However, the deep attack which was conducted by 33 AH-64 Apaches in 2003 to destroy Iraqi Republican Guard forces was a failure.[59]

FM 1-100, *Army Aviation Operations,* which was published in 1997 was current at the beginning of OEF. It considered army aviation as a part of land power, not the air component of the U.S. Army. Fighting the land battle and supporting ground operations was accepted as army aviation's primary mission. FM 1-100 stated that attack helicopter units could support ground forces in close combat in addition to conducting deep operations. Attack helicopter units' primary mission was to attack to destroy enemy ground forces, such as armored and mechanized forces. Attack helicopters could also support the ground forces by securing their flanks, providing aerial fires, target acquisition, and reconnaissance.

FM 1-112, *Attack Helicopter Operations*, published in 1997, stated that deep operations were conducted at corps and division levels. It also described the target for deep operations as "enemy forces that currently are not engaged but that could influence

[59] Jamie LaValley, "A Hard Lesson Learned: The Needs for Weapons and Tactics Instruction in Army Aviation," *Aviation Digest* 1, no. 3 (July-September 2013): 39-42.

division or corps close operations within the next 24 to 72 hours."[60] Deep attack was usually a high risk and low cost operation.

However, the battlefield in Afghanistan was completely different than the one envisioned in Air Land Battle Doctrine. In contrast to a conventional adversary, the enemy was a group of irregular insurgents who lived in remote villages and hid in caves. While the previous enemy was expected to use massive power such as heavy armored and mechanized forces, the dispersed insurgents generally applied small arms and rocket propelled grenades (RPG) during OEF. "There were no unit boundaries for close, deep, and rear battle areas as in the Air Land Battle concept."[61] In Afghanistan, the insurgents did not have air defense coverage either.

During OEF, AH-64 Apache units were never requested to conduct deep attack against armored and mechanized forces or high-pay off targets behind the FLOT. Instead, they usually provided aviation support to ground maneuver forces by conducting security, reconnaissance and close combat attacks when they were needed. In Afghanistan, army aviation units did what they did in Vietnam nearly 40 years ago.

Since mid-2003, army aviation shifted its mentality from deep attack to close combat attack (CCA) and support of the ground maneuver forces in the close fight.[62] The elimination of army aviation units at the corps level, and EAC (theater) aviation brigades

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[60] Department of the Army, Field Manual (FM) 1-112, *Attack Helicopter Operations* (Washington, DC: Department of the Army, 1997), 1-6.

[61] Todd G. Thornburg, "Army Attack Aviation Shift of Training and Doctrine to Win the War of Tomorrow Effectively" (Master's Thesis, U.S. Marine Corps Command and General Staff College, Quantico: VA, 2009), 7.

[62] Buss, 1.

and armored cavalry regiments were another indicators of this mentality change.[63] This was understandable, as those units were primarily designed to conduct deep attack.

Similar to the elimination of army aviation units at corps level, Deep Operations Coordination Cells (DOCC) were also eliminated. DOCCs were the centers where high payoff targets for deep operations were planned and executed at corps and division level.[64] DOCCs were also responsible for coordinating and synchronizing intelligence, aviation, and fires for the deep attack within the main command post.

FM 3-04.126, *Attack Reconnaissance Helicopter Operations*, published in 2007, superseded FM 1-112. FM 3-04.126 enumerated the primary missions of attack reconnaissance helicopter units as reconnaissance, security, attack and, movement to contact. According to FM 3-04.126, the two basic types of attack were CCA and interdiction attack (IA). This manual changed deep attack to IA which was very close to air interdiction (AI) by definition.

Although current doctrine speaks of both CCA and IA, army aviation in Afghanistan generally conducted only CCA. FM 3-04.126 defines CCA as "a hasty or deliberate attack by Army aircraft providing air-to-ground fires for friendly units engaged in close combat."[65] The planning and training had utmost importance for the effective

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[63] Richard M. Beckinger, "Theory , Its Impact on Military Doctrinal and Organizational Change During a Time of War" (Monograph, School of Advanced Military Studies, 2006), 36.

[64] Department of the Army, FM 1-100, *Army Aviation Operations*, B-4; Department of the Army, Field Manual (FM) 3-04.111 (FM 1-111), *Aviation Brigades* (Washington, DC: Department of the Army, 2003).

[65] Department of the Army, Field Manual (FM) 3-04.126, *Attack Reconnaissance Helicopter Operations* (Washington, DC: Department of the Army, 2007).

execution of a CCA. Since targets were in close proximity to friendly forces, both aviators and ground forces should be trained properly to prevent fratricide, especially in small units such as teams and companies.

Army aviation adjusted the TTPs to conduct close combat attacks in the OE of Afghanistan.[66] Since attack helicopter units mainly focused on deep attack in the 1980s and 1990s, the first group of aviators who deployed to Afghanistan in 2002 were naturally trained for deep attack.[67] However, during Operation Anaconda, the first major battle in Afghanistan, they had to conduct CCA in close proximity to friendly forces at very high altitudes. In this battle, high elevation, dispersed enemy, and the compartmented terrain structure forced aviators to relearn and/or refine some procedures. One of the most obvious lessons learned from Operation Anaconda was the need for effective AGI. Since CCA required close coordination between pilots and ground forces on the battlefield, both army aviation units and ground forces had to remember call for fire procedures.

Hovering Fire–Running and Diving Fire

In addition, significant TTP changes occurred in the aerial maneuvers conducted at high altitudes during OEF. Decreased lift capability at high elevation appeared as an enormous obstacle for attack helicopter pilots. The AH-64 Apaches were unable to hover at the altitudes of the Afghan mountains.[68] Moreover, the rugged and compartmented

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[66] James, 10.

[67] Ibid., 16.

[68] Stinger; James, 16.

terrain helped insurgents to conceal themselves and their weapon systems. In response to the restrictions, attack helicopter pilots, who were familiar with the hovering fire technique, began to employ running and diving fire techniques at high altitudes and high gross weight.[69] The current TC 1-25, *Aircrew Training Manual: Attack Helicopter AH-64D,* describes these three types of firing techniques.[70] In hover fire, the helicopter must be below effective translational lift airspeed, a condition experienced in either in-ground effect (IGE) or out-of-ground effect (OGE). Since hovering fire requires more power than the other two, pilots in Afghanistan had to be especially aware when conducting during high temperature, high altitude, and high gross-weight conditions. When applying diving fire techniques, the vulnerability of the aircraft to small arms fire is lower. It also increases armament load and improves accuracy. Similar to diving fire, running fire is conducted at airspeeds above effective transitional lift (ETL). This technique is effective during terrain flight, especially in regions where the usage of the hover fire technique is limited by terrain obstacles. Additionally, it is the best technique when diving fire can't be employed because of the surface to air missile (SAM) threats.

During OEF, insurgents generally employed high volumes of small arms and machine guns, and RPGs. Attack helicopter pilots had been trained to benefit from the maximum effective range of their weapon systems, and to stay out of range of the enemy weapon systems. The closer an aircraft approaches to the enemy, the more it is susceptible to enemy fires. In order to stay out of the enemy's small arms range, they

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[69] James, 16.

[70] Department of the Army, Training Circular (TC) 1-25, *Aircrew Training Manual: Attack Helicopter AH-64D* (Washington, DC: Department of the Army, 2007), 4-171.

were trained to engage targets in the last one third of the maximum effective range of their weapon system. However, most of the time friendly forces were so close to enemy forces that aircraft were not be able to stay out of the range of the enemy small arms. The attack aviation pilots had to fly into enemy small arms range to support ground forces effectively and to avoid fratricide.[71]

Terrain Flight–High Altitude Flight

Pilots traditionally had been trained to use terrain flight modes, flying as low as possible to the ground to avoid enemy detection and to survive in a high-threat environment. Previously, aviators employing terrain flight modes would fly at the bottom of the valley providing cover and concealment. Low-level, contour, and nap-of-the-earth (NOE) were terrain flight modes selected by pilots based on METT-TC. Modes of terrain flight are depicted in figure 3.

[71] Brockhard, 25.

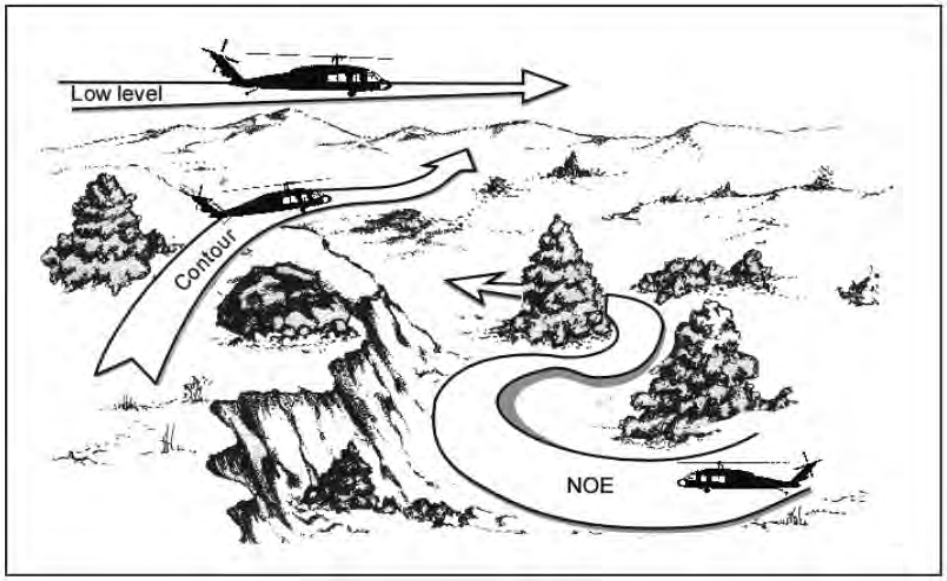

Figure 3. Terrain Flight Modes

Source: Department of the Army, Field Manual (FM) 3-04.203, *Fundamentals of Flight* (Washington, DC: Department of the Army, 2007), 5-3.

Despite several advantages of terrain flight, aircraft were more vulnerable to a wide variety of enemy weapons such as small arms, RPG and, man portable air defense systems (MANPADS) when flying low to the ground. Natural environmental obstacles such as power lines, fog and dust aggravated the threat in low altitude flight. Many pilots who served in Afghanistan reported that environmental obstacles were the first and foremost threat for aviators.[72] During terrain flight, pilots had to deal with less visual acuity, limited viewing distances, and reduced depth perception. They had to be vigilant in detecting terrain obstacles and understand the effects of the terrain throughout the

[72] Liles and Bolkcom, 33.

flight. Furthermore, terrain flight modes increased the workload of aircrews dramatically and resulted in psychological and physiological stress.[73]

As the aircraft survivability systems especially common missile warning system (CMWS) were fielded, the MANPADS threat drastically diminished. CMWS allowed pilots to fly at higher altitudes where they could stay far from the missiles, even if not always totally out of their maximum range. Flying at higher altitudes not only eliminated threats such as shoulder launched missiles, small arms, machine guns and RPGs, but also automatically reduced many other risks which stemmed from terrain flight. However, in practice, aircraft loss reports showed that many pilots insisted on flying low to the ground.[74] In spite of the numerous advantages of flying at high altitude, they were still unwilling to change their flight profile.

Aircraft Deployed: CH-47–UH-60/AH-64–OH-58

During OEF, the roles of aircraft were also changed. The types of helicopters which would operate in a particular area were chosen based on their capabilities. Each aircraft had different lift capabilities. Degraded performance of aircraft led to inevitable changes in the roles of platforms. On the other hand, at the beginning of OEF general support and lift aircraft were not escorted by attack aircraft. Attack helicopters' escort missions started after Chinooks and Blackhawks were fired upon from the ground.[75]

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[73] Department of the Army, Field Manual (FM) 3-04.203, *Fundamentals of Flight* (Washington, DC: Department of the Army, 2007), 5-2.

[74] LaValley, 39-42.

[75] Grau and Billingsley, 97-98.

Daytime Flight–Nighttime Flight

On the other hand, some operational practices differed from unit to unit in Afghanistan. Some task forces generally flew at night to benefit from its advantages.[76] Since nights were normally cooler than daytimes, aircraft required less power. Furthermore, army aviation pilots used the advantage of night vision devices (NVD) such as night vision goggles (NVG) and forward looking infrared systems (FLIR). However, Special Operations pilots, who were more experienced on night flight, were assigned to conduct some unique and specialized night missions.

Survey Results

The army aviation participants were requested to determine if U.S. Army Aviation units had TTPs they needed to address the environment of Afghanistan before deployment. As depicted in table 9, six of the seven participants (86 percent) reported that U.S. Army Aviation units had appropriate TTPs before deployment. One (14 percent) disagreed for this question.

Another question to be determined was if U.S. Army Aviation units had the SOPs needed to address the environment of Afghanistan before deployment. The responses were the same as the previous question.

[76] James, 9.

Table 9. Pre-deployment doctrine (Army Aviation)				
Before deployed to Afghanistan, the U.S. Army Aviation units had:	Agree	Neutral	Disagree	Total
TTPs they needed to address the environment of Afghanistan.	6	0	1	7
	86%	0%	14%	100%
SOPs needed to address the environment of Afghanistan.	6	0	1	7
	86%	0%	14%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

The participants were asked if U.S. Army Aviation units changed their TTPs in response to the effects of the OE (tables 10 and 11). Four of the seven army aviation branch participants (57 percent) marked agree and the rest (43 percent) selected neutral. Four of the six infantry branch officers (67 percent) marked agree for the same question. The number of the infantry officers who marked neutral was two (33 percent).

Similarly, four of the seven army aviation branch participants (57 percent) marked agree for "the U.S. Army Aviation units changed their SOPs in response to the effects of the OE."

Table 10. Doctrinal Changes (Army Aviation)				
In response to the effects of the OE, the U.S. Army Aviation units:	Agree	Neutral	Disagree	Total
changed their TTPs.	4	3	0	7
	57%	43%	0%	100%
changed their SOPs.	4	2	1	7
	57%	29%	14%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Table 11. Doctrinal Changes (Infantry)				
	Agree	Neutral	Disagree	Total
In response to the effects of the OE, the U.S. Army Aviation units changed their TTPs.	4	2	0	6
	67%	33%	0%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Participants were requested to determine if the enemy changed its TTPs in response to U.S. Army Aviation operations in Afghanistan. Four army aviation officers (57 percent) and four infantry officers (67 percent) agreed that the enemy adjusted its tactics, techniques and procedures in response to the army aviation operations. Moreover, none of the participants disagreed with this statement.

Table 12. Enemy doctrinal changes (Army Aviation)				
	Agree	Neutral	Disagree	Total
In response to U.S. Army Aviation operations in Afghanistan, the enemy changed its TTPs.	4	3	0	7
	57%	43%	0%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Table 13. Enemy doctrinal changes (Infantry)				
	Agree	Neutral	Disagree	Total
In response to U.S. Army Aviation operations in Afghanistan, the enemy changed its TTPs.	4	2	0	6
	67%	33%	0%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

For the open-ended question concerning enemy's adjustments, one army aviation officer and one infantry officer stated that the enemy targeted aviation assets, especially the CH-47 Chinook, as a high value target in order to achieve the catastrophic effect of destroying an aircraft. One infantry officer specified that the enemy targeted aircraft during infiltration and exfiltration operations. One participant reported that the enemy favored operating during the daytime in response to army aviation's night vision capability.

Summary

During OEF, U.S. Army Aviation had to refocus on the close combat attack that it successfully conducted in Vietnam nearly 40 years ago. In accordance with this mental shift, the primary mission of the attack helicopter units changed to support ground maneuver forces. In addition, army aviation recalled Vietnam-era techniques such as call for fire and running and diving fire employments. As the CMWS were fielded, many pilots flew at high altitudes in order to avoid the risks associated with terrain flight.

Survey results supported the information gained from the literature and the interviews. A large number of participants believed that army aviation units had adequate TTPs and SOPs needed to address the environment of Afghanistan before deployment. Similarly, most of them reported that they changed their TTPs and SOPs in response to the OE in Afghanistan. Interestingly, the same percentage of participants from both branches also stated that the enemy changed its TTPs in response to U.S. Army Aviation operations in Afghanistan.

Training

Environmental Flight Training

Awareness of the capabilities and limitations of aircraft and aircrew are always vital in aviation. Like aircraft which have many mechanical limitations affected by engines, altitude, bank angle, and speed, pilots also have limitations such as physiological and psychological. Pilots should always take into account both of these type of limitations especially when flying in risky OEs like Afghanistan. High altitude mountains, arid deserts and extreme weather conditions adversely affected the capabilities and effectiveness of aircraft and aircrew. In these environments pilots may

not be able to execute maneuvers that are standard due to constraints on both equipment and personnel given the environmental conditions.

OEF presented significant challenges associated with the OE that were identified as mission risks. Over time these risks were mitigated by improved pilot and aircrew training programs. Initially, U.S. Army Aviation units' training was insufficient to meet the needs of the OE in Afghanistan. As units realized their incompetency and gained experience in the OE, they determined their training requirements and methods needed adjustment. The flight school curriculum, which was previously concentrated on conventional warfare and technological superiority, was updated to address to the high altitude, desert and urban environment in Afghanistan.[77]

In the initial deployments of OEF, some aircrews did not receive sufficient and/or appropriate preparatory training due to short deployment notification. Over time OEF pre-deployment training became more organized and systematic. This led to aircrews and pilots improving their safety and operational effectiveness over time. In their interviews, many pilots reported that the pre-deployment training was significantly realistic and beneficial.[78]

The training most emphasized during pre-deployment was high altitude flight training. Landing and taking off maneuvers from high-altitude pinnacles at high gross weight presented challenges for aviators. When the first army aviation task force deployed to Afghanistan there were just a few pilots who had trained in high altitude

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[77] Liles and Bolkcom, 35-36.

[78] Gary Means, Interview by Grégoire de Boisfleury, February 10, 2010, Operational Leadership Experiences Project, Combat Studies Institute, 6.

flight in Colorado and Canada.[79] However, the number of the pilots who had high altitude mountainous environment training gradually increased throughout OEF. High altitude training was eventually a requirement for the all aircrew prior to deployment.[80]

High-Altitude Army National Guard Aviation Training Site

High-Altitude Army National Guard Aviation Training Site (HAATS) was initially established under the name of Colorado High Altitude Training Site (CHATS) in 1985 in Gypsum, Colorado. U.S. Army Aviation Center, Ft. Rucker approved HAATS's training program in 1988. Since then, army aviation pilots have been individually trained at this institution. It is a unique institution which hosts and trains rotary-wing military pilots from all around the world in power management and environmental flight techniques in high altitude and high gross weight conditions. The main goal of the one-week HAATS training is to prevent crashes and increase effectiveness of the aviation operations by teaching pilots the terrain and their own limitations. HAATS includes Colorado's Rocky Mountains which is an ideal training site with altitudes ranging from the airport at 6,500 feet to peaks of 14,000 feet.[81]

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[79] James, 10.

[80] 25th Combat Aviation Brigade, "High-Altitude Mountainous Environment Training" (Schofield Barracks, HI: Draft Environmental Assessment, 2011), 1-3, accessed March 13, 2015, http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Hawaii/2010s/2011-07-23-DEA-High-Altitude-Mountanous-Environment-Training.pdf.

[81] HAATS, "High-Altitude Army National Guard Aviation Training Site," accessed May 11, 2015, http://co.ng.mil/ARMY/HAATS/Pages/FAQ.aspx.

HAATS training has been one of the most beneficial OEF pre-deployment training for aviators.[82] According to interviews over the past ten years with OEF veteran pilots and the survey conducted by the author, HAATS training, contributed tremendously to OEF aircrews' confidence to operate helicopters appropriately and safely at maximum gross weights in the mountainous environment of Afghanistan. It also dramatically increased the pilots and crews' situational awareness. Pilots who understood the terrain and their own limitations could often carry more ammunition, food or personnel.

Though training in HAATS gained importance throughout OEF, unfortunately the number of the pilots who were trained in HAATS increased gradually due to resource limitations. Today, HAATS continues to train over 400 aircrews from multiple countries and all services annually.[83] However, its capacity is limited to approximately twelve pilots and six helicopters at a time.[84] Because of the inadequate training capacity and high demand of international and joint service for the course only a small percentage of U.S. Army Aviation pilots and crews continue to have the opportunity to attend HAATS.

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[82] James, 4.

[83] HAATS, "High-Altitude Army National Guard Aviation Training Site," accessed May 11, 2015, http://co.ng.mil/ARMY/HAATS/Pages/Facts.aspx.

[84] HAATS, "High-Altitude Army National Guard Aviation Training Site," accessed May 11, 2015, http://co.ng.mil/ARMY/HAATS/Pages/default.aspx; Eaglecounty, "HAATS," accessed May 11, 2015, http://www.eaglecounty.us/Airport/General_Aviation/HAATS/.

High-Altitude Mountain Environmental Training Strategy

The limited capacity of HAATS compelled FORSCOM and U.S. Army Aviation to develop the High-Altitude Mountain Environmental Training Strategy (HAMETS) to prepare aviators for OEF deployments. HAMETS, which was initiated at Fort Carson, Colorado, is typically a two-three-week training package to help brigade commanders train pilots and crews.[85] HAMETS can be conducted at a unit's home station. HAMETS includes individual pilot training, flight simulator training, multi-aircraft training, and nighttime training. Different than HAATS, which trains pilots individually, HAMETS trains pilots as a unit in high-altitude flight planning and aircraft operations in mountainous environments.

Today, high-altitude training is a requirement for all pilots and crews who will deploy to Afghanistan. Commanders and instructors plan HAMETS training to be as realistic as possible. However, it is hard to find an OE as harsh as Afghanistan in the vicinity of an aviation unit's home station. Unlike HAATS whose training site is comprised of the Rocky Mountains, HAMETS training may not be as beneficial to a unit due to the absence of similar high altitude mountains at a unit's home station.

Training Other Than Environmental Flight Training

In addition to HAATS and HAMETS training, pilots and crew had JRTC and/or National Training Center (NTC) rotations before their deployments to OEF. Since the terrain elevation and structure at JRTC and NTC are not similar to Afghanistan, power

[85] The United States of Army, "Stand-to," accessed May 11, 2015, http://www.army.mil/standto/ archive/2010/03/09/.

management and high altitude flight training could not be practiced. However, army aviation units that went to JRTC and NTC were able to conduct AGI and dust landing training as part of their pre-deployment preparations.[86]

Operation Anaconda demonstrated that aircrews had insufficient training against a dispersed enemy equipped with small arms, RPGs and ground to air missiles in high altitude mountains. Moreover, they had never trained for close combat attack in a close fight with friendly forces. After Operation Anaconda, aviators began focusing on air ground integration, close combat attack (CCA) and call for fire procedures. Additionally, CCA and call for fire procedures entered the OH-58D and the AH-64 aircrew training manuals (ATM)s.[87] Attack helicopter pilots also had to relearn old techniques like running and diving fire at high elevations and high gross weight.

In addition to the training mentioned above, NVG flight training, familiarization and qualification training on new aircraft and equipment such as ASE and aviation life support equipment (ALSE), BAE and LNO training were also conducted before and during deployments to OEF. The Army Aviation benefited greatly from the Aviation Combined Arms Tactical Trainer (AVCATT) system to conduct some of this training, especially ASE training.[88]

Many times, pilots who had special training and experience were assigned to execute exceptional and dangerous missions. For instance, in 2006, the pilots trained in

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[86] Conyers, 4; Jeff Rosenberg, Interview by Angie Slattery, October 7, 2010, Operational Leadership Experiences Project, Combat Studies Institute, 5.

[87] Stinger, 30.

[88] Michael S. Kelley, "Aircraft Mission Survivability Training: Preserving the Force," *Aviation Digest* 3, no. 1 (January-March 2015): 11-12.

HAATS in Colorado were chosen for a rescue mission at 13,000 feet. Since they were trained specifically for this environment, they were familiar with the effects of the high elevation on aircraft and aircrews. Pilots who experienced emergency situations stated they owed their lives to the training they received at HAATS.[89] Likewise, in many cases, senior pilots executed the difficult missions such as air assaults instead of young aviators, especially during the initial months of their deployments.[90]

Survey Results

The army aviation participants were requested to determine if U.S. Army Aviation units were trained to operate in the environment of Afghanistan before deployment to Afghanistan. As is depicted in figure 14, five of the seven participants (72 percent) reported that they were trained specific to the environment of Afghanistan before deployment. One of them (14 percent) disagreed for this question.

Another question was to determine if U.S. Army Aviation units had made changes in training in response to the effects of the OE during deployment. Figure 15 shows that five aviators (72 percent) agreed with this statement. Two officers (28 percent) marked neutral and none of them disagreed with this statement.

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[89] Gaub, 12.

[90] William Hanna, Interview by Lisa Beckenbaugh, March 4, 2013, Operational Leadership Experiences Project, Combat Studies Institute, 7.

Table 14. Pre-deployment Training (Army Aviation)				
	Agree	Neutral	Disagree	Total
Before deployed to Afghanistan, the U.S. Army Aviation units were trained to operate in the environment of Afghanistan.	5	1	1	7
	72%	14%	14%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Table 15. Changes on Training (Army Aviation)				
	Agree	Neutral	Disagree	Total
In response to the effects of the OE, the U.S. Army Aviation units changed their training.	5	2	0	7
	72%	28%	0%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

In the open-ended box concerning pre-deployment training, two officers reported that their training was applicable and they had basic skills, if not the best, to accomplish the mission. While one of the participants stated they completed HAATS training before deployment, two officers pointed out that they lacked high altitude training. One participant reported that they did not have enough night flight training.

Regarding changes and recommendations, one officer reported that all of the pilots in command (PC)s were given HAATS and NVG/sling training. Two aviators spoke of the importance of HAATS and HAMETS training. Another officer

recommended that pilots should have consistent environment flight training in order to reduce risk and increase capability.

Summary

U.S. Army Aviation successfully trained aircrews throughout OEF. When the first task force was deployed, most of the aircrews had only been prepared for a conventional war. They had not been trained for an OE such as Afghanistan. In parallel with the mentality shift from conventional war to irregular war, army aviation was forced to change its training. The flight school curriculum, which previously concentrated on conventional warfare and technological superiority, was changed to adapt to the high altitude mountains, desert and urban environments of Afghanistan.

High altitude training was eventually acknowledged as a requirement for all aircrews prior to deployment to Afghanistan. As seen in interviews and through the survey, HAATS and HAMETS training programs significantly helped army aviation to train aircrews on power management at high altitudes which was credited with improving mission success and safety. These training programs also gave pilots the necessary skills to respond to in flight emergencies and to bring them home safely.

However, unlike high altitude operations, desert operations were not given enough importance. Brownout incidents which generally occurred in desert operations is one of the leading causes of aviation accidents. An article written by Program Executive Officer for Army Aviation Major General Joseph L. Bergantz in 2004 states that “almost

75 percent of aircraft accidents in theater are related to brownout flight conditions."[91] Similarly, according to another article written by Dr. Chris. W. Johnson, Professor at the University of Glasgow in Scotland, U.S. Army Aviation had 41 brownout accidents between 2002 and 2005 worldwide.[92] This has been a significant issue of concern since the very first aviation task force deployed to Afghanistan, and a CH-47 Chinook crashed on its first mission due to a brown out.[93] Inadequate training is one leading causes of brownout accidents. While army aviation trained pilots on high altitude flight in formal courses such as HAATS and HAMETS, army aviation had not instituted formalized training in desert operations. This type of training was being conducted informally on the ground in forward deployed environments by senior pilots who were passing on their experience in desert operations to their junior aviators.

There are other significant issues affecting army aviation in addition to the lack of desert environment training for aviators. One issue as mentioned above is the lack of sufficient capacity at HAATS. Another is a manning issue where staffing of aviators in BAEs is lower than their MTOE. This is exasperated by the fact that these few aviators lack adequate training and experience for their given mission sets.

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[91] Joseph L. Bergantz, "Army Aviation Transformation," *Army* 54, no. 1 (January 2004): 14-20, accessed November 13, 2014, https://lumen.cgsccarl.com/login?url=http://search.proquest.com/docview/237082580?accountid=28992.

[92] Chris W. Johnson, "Interactions between Brown-out Accidents and Night Vision Equipment in Military Aviation Accidents," accessed March 13, 2015, http://www.dcs.gla.ac.uk/~johnson/papers/JWSSC2009/Brownout.pdf.

[93] Grau and Billingsley, 98.

Equipment

Aircraft

TF Talon, the first conventional army aviation unit deployed to Afghanistan to support TF Rakkasan, was initially comprised of three different types of platforms: AH-64 Apache, CH-47 Chinook, and UH-60 Blackhawk.[94] The first deployed models of these platforms were AH-64A Apache, CH-47D Chinook, UH-60A Blackhawk, and UH-60L Blackhawk. The OH-58 Kiowa was also added later.

Over time, U.S. Army Aviation did not change these platforms. However, each of the helicopters was upgraded to higher models several times to meet the requirements of the OE of Afghanistan. In addition to AH-64A models, the AH-64D model Apache Longbows, which were equipped with additional systems, such as target acquisition systems and advanced sensors, were deployed to Afghanistan. However, 24 AH-64E Apache Guardian model attack helicopters, which were fielded in 2013, were deployed to Afghanistan in May 2014. Similarly, because of the altitude, distance, and lift requirements, Chinooks were also upgraded from the D to the F model. With this upgrade, Chinooks became 27 percent more powerful.[95]

Generally, whenever an aircraft was upgraded without replacing both engine and drive train to a more powerful one, performance actually declined. This was due to the new aircraft being heavier.[96] During Operation Anaconda, when commanders required reinforcement by attack helicopters, they tended to bring AH-64D model Apache

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[94] Grau and Billingsley, 96.

[95] Williams, 386.

[96] James, 8.

Longbows from Kuwait to Afghanistan. However, as they noticed that D models were 3,000 pounds heavier than current A models, they had to abandon this idea.[97]

None of the aircraft upgraded during OEF solved the power problem. During OEF, degraded performance of aircraft led to inevitable changes on the roles of platforms. Many aviators complained about the insufficient performance of all except the CH-47 Chinook. Although the harsh OE of Afghanistan adversely affected its performance, it could provide enough power for aviators when needed. The types of helicopters which would operate in a particular area were chosen based on their capabilities. For instance, under conditions where CH-47s could normally carry more than 30 soldiers, UH-60s were limited and could only transport four to seven soldiers.[98] CH-47s, which were traditionally known as heavy lifters before OEF, became more heavily evolved in assault and movement operations.[99] The attack helicopter perspective was similar. Since, AH-64s could operate better than the OH-58 at high altitudes and high temperature; OH-58s were located in sectors where their limited capability was more easily employed.[100]

RAH-66 Comanche Armed Reconnaissance Program

The RAH-66 Comanche Armed Reconnaissance Program was cancelled in 2004 after two decades of effort and investment. Previously, the intention of acquiring this

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[97] Grau and Billingsley, 200.

[98] Karl Wojtkun, Interview by Jenna Fike, July 9, 2012, Operational Leadership Experiences Project, Combat Studies Institute, 11.

[99] Williams, 380; Wojtkun, 11.

[100] Ibid., 10.

light scout/attack helicopter was to fight in a deep attack. However, during OEF, in parallel with the doctrine shift from deep operations to close combat operations, the capability needs of an attack aircraft also changed. In addition, the RAH-66 Comanche program was restructured many times and constantly delayed in fielding. The program was eventually cancelled because of budget constraints,[101] a changing threat environment, and the evolving nature of future requirements.[102] After the cancellation, $39 billion dollars[103] which had been allocated for the RAH-66 Comanche Program was used for other aviation programs such as upgrading other aircraft and acquiring more helicopters.

Aircraft Survivability Equipment

Aircraft survivability equipment (ASE) is equipment designed to protect aircraft from threats. Normally ASE equipment includes integrated electronic countermeasures (ECM) such as IRCM, radar warning, missile warning, and laser warning systems, and flare/chaff expendables. According to CRS report submitted to Congress in 2004, all AH-64 Apaches had IR and radar jammers, passive RWR, laser warning receiver, and chaff dispensers as ASE equipment.[104] Throughout OEF, AH-64 Apaches and other helicopters were also equipped with these and many other survivability systems such as the common missile warning system (ECWS). However, although many pilots considered these

[101] Law, 8.

[102] Macklin, 18.

[103] Ibid.

[104] Liles and Bolkcom.

warning systems as helpful some others stated that they could not adequately take advantage of these systems. Since the insurgents were mainly equipped with small arms, machines guns and RPGs, the possibility of a SAM attack was considerably low. As electronic and infrared countermeasures do not affect small arms, machine guns and RPGs, the pilots rarely needed most of them. However, some aircraft survivability systems were more beneficial than countermeasures. For instance, engine filters preserved engines by preventing them from sand ingestion in dusty zones. Installing engine filters resulted in not only saving lives but also saving million dollars.

Aircraft Life Support Equipment

When OEF began, U.S. Army Aviation had been following some ALSE procurement programs based on the lessons learned during Operation Desert Shield/Storm. However, since the OE of Afghanistan was different than previous OEs, they had to revise the requirements. For instance, pilots and crews who flew above 10,000 feet, especially High Altitude Rescue Teams (HART), needed oxygen devices. The air warrior (AW) ensemble, which included electronic kneeboard, laser protection, helmet-mounted display, oxygen systems and protective shield for the face, began fielding in 2003.[105] Army Aviation tested some parts of these systems in Afghanistan to meet the need of existing war.

Over time, the AW ensemble concept enlarged. In addition to the first generation AW ensemble, the third generation AW offered several other features such as ballistics

[105] Williams, 310.

protection, and chemical, biological, radiological, and nuclear (CBRN) protection.[106] This ensemble also provided useful kits for escape, survival, and recovery in emergency or combat situations. Additionally, the third generation AW was compatible with all types of army aviation aircraft used in Afghanistan.

As the U.S. entered Operation Enduring Freedom, tactical operations (TACOPS) officers were responsible for aviation battlefield survivability which included aircraft life support equipment (ALSE).[107] Over the years, ALSE officer positions were created to practice ALSE programs. The three-week Aviation Tactical Operations Officer's Course which was the first course on ALSE began in 2003. After that several other courses were conducted throughout OEF to close the expertise gap for ALSE. On the other hand, all pilots and crews are required to receive individual ALSE training at least once a year to maintain the ability to use and operate ALSE on the battlefield.[108]

Survey Results

The army aviation branch participants were requested to determine if U.S. Army Aviation units had the equipment they needed to address the environment in Afghanistan before deployment. As depicted in table 3, four of the seven participants (57 percent) reported that they had the equipment they needed to address the environment in

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[106] Department of the Army, Training Circular (TC) 3-04.72 (FM 3-04.508), *Aviation Life Support System Management Program* (Washington, DC: Department of the Army, 2009), 1-2.

[107] Michael S. Kelley, "From Tactical Operations Officer to the Aviation Survivability Program," *Aviation Digest* 1, no. 2 (April-June 2013): 24-27.

[108] Department of the Army, TC 3-04.72, *Aviation Life Support System Management Program*, 5-2.

Afghanistan. When they were asked if U.S. Army Aviation units had the aircraft they needed to address the environment in Afghanistan before deployment, the number of the officers who mark agree increased to six (86 percent).

Table 16. Pre-deployment Equipment (Army Aviation)				
Before deployed to Afghanistan, the U.S. Army Aviation units:	Agree	Neutral	Disagree	Total
had the equipment they needed to address the environment in Afghanistan.	4	2	1	7
	57%	29%	14%	100%
had the aircraft they needed to address the environment in Afghanistan.	6	0	1	7
	86%	0%	14%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Both army aviation and infantry officers were also asked to determine if U.S. Army Aviation units changed their weapon systems in response to the OE in Afghanistan. Table 4 and 5 show that whereas two aviation officers (29 percent) and one of the six infantry officers (17 percent) marked agree, two aviation officers (29 percent) and two infantry officers (33 percent) marked disagree. The rest of each group (42 percent of army aviation and 50 percent of infantry) reported neutral.

They were also requested to determine if U.S. Army Aviation units changed their equipment in response to the OE in Afghanistan. While five of the army aviation officers (71 percent) agree with this statement only one of the six infantry officers (17 percent)

marked agree. None of the aviators (0 percent) marked disagree for this statement (table 4 and 5).

Table 17. Changes on Equipment (Army Aviation)				
In response to the effects of the OE, the U.S. Army Aviation units:	Agree	Neutral	Disagree	Total
changed their weapon systems.	2	3	2	7
	29%	42%	29%	100%
changed their equipment.	5	2	0	7
	71%	29%	0%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

Table 18. Changes on Equipment (Infantry)				
In response to the effects of the OE, the U.S. Army Aviation units:	Agree	Neutral	Disagree	Total
changed their weapon systems.	1	3	2	6
	17%	50%	33%	100%
changed their equipment.	1	3	2	6
	17%	50%	33%	100%

Source: Created by author, data from CGSC Survey 15-02-015, April 21, 2015.

In an open-ended box concerning pre-deployment equipment, three army aviation officers and one infantry officer reported that they had sufficient equipment to be successful in Afghanistan. For the questions regarding changes and recommendations, an infantry officer reported that U.S. army aviation did not change the weapons and

equipment to meet demands for a complex, hybrid threat model. One infantry officer spoke of the necessity for better rotary wing platforms as a long term solution since AH-64 Apache and UH-60 Blackhawk did not have sufficient power to operate in Afghanistan. Two infantry officers recommended that more capable utility and scout helicopters which can operate effectively in high altitude should be developed.

Summary

Four different types of rotary-wing platforms; AH-64 Apache, CH-47 Chinook, UH-60 Blackhawk and OH-58 Kiowa; were used in Afghanistan during OEF. Since the harsh OE of Afghanistan adversely affected their performance, only the CH-47 Chinook could provide enough power for aviators when needed. These platforms were upgraded to more capable models several times to meet the requirements of the OE of Afghanistan. In addition, degraded performance of aircraft led to inevitable changes in the roles of platforms. The types of helicopters which would operate in a particular area were chosen based on their capabilities. CH-47s, which were traditionally known as heavy lifters before OEF, became more heavily involved in assault and movement operations.

After two decades of effort and investment, The RAH-66 Comanche Armed Reconnaissance Program was cancelled in 2004 due to budget constraints, a changing threat environment, and the evolving nature of future requirements. The money allocated for the RAH-66 Comanche Program was used for other aviation programs such as upgrading the other aircraft and acquiring more helicopters after the cancellation.

CHAPTER 5

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

Summary

Table 19. Operational Environment (OE) and Its Effects	
OE in Afghanistan	Effects on Army Aviation Operations
Terrain	Need for large forces
Large area of operation	
Mountainous	Physiologically and psychologically tired aircrew
High altitude	
Complex and compartmented	
Steep slope	Limited performance capabilities
Rugged	Aircraft lift capability
Deep valleys	Maneuver capability
Desert	
	Increased vulnerability
Enemy	
Ideologically motivated	Limited landing zones
Dispersed	
Lives in remote villages	Limited routes
Hides in caves	
Equipped with small arms, machine guns and RPGs	Limited support capability
	Limited areas of engagement
	Difficult target spotting
Weather	
Extremely hot (summers)	Increased maintenance needs
Extremely cold (winters)	
Varies quickly	Shortened radio ranges
High winds	
Sand storms	Difficult navigation
Dry	
Low visibility	

Source: Created by author.

Table 20. Organization	
Organizational Changes	Consequences
Creation of multi-functional aviation brigades (MFAB)s and multi-functional aviation task forces (MATF)s	Army aviation units transformed into smaller, modular, adaptable, agile, deployable and logistically supportable forces. MFAB and MATF helped U.S. Army Aviation to meet the requirements of the war on terror. The new units gained necessary assets and capabilities to conduct full spectrum operations.
Creation of Brigade Aviation Element (BAE)	The army aviation understood the importance of the air ground integration (AGI) in the early days of OEF. BAEs with seven aviators were created in every BCTs to meet the AGI need. Initially, BAEs were very beneficial for both army aviation units and ground forces. However, over time, it seemed that they lost their importance. Currently, they have manning and training problems.
Co-locationing with supported ground units	The need for robust army aviation support due to the large AO and AGI need forced army aviation units to co-locate with supported ground forces. Although there were some command and control problems, it worked well. They successfully integrated, coordinated and synchronized air ground operations.

Source: Created by author.

Table 21. Doctrine	
Doctrinal Changes	Consequences
Mentality shift from deep attack to close combat attack	Since the OE in Afghanistan was different than the one envisioned in conventional warfare, the Air Land Battle doctrine which had been used since 1982 were abandoned. During OEF, army aviation refocused counterinsurgency operations. Army aviation units heavily provided aviation support to ground maneuver forces. As a result of this change, MFABs, MATFs and BAEs were created. In addition, the attack helicopter units at division and corps level and the deep operation coordination cells (DOCC)s were eliminated.
Tactics, techniques and procedures (TTP) were adjusted to meet the needs of Operation Enduring Freedom (OEF) and counterinsurgency operations	In accordance with the mentality shift, the U.S. Army Aviation refocused on AGI and they recalled Vietnam-era techniques such as call for fire, running fire and diving fire. Army aviation operations became more effective after they learned those techniques. Most pilots begun to fly at high altitudes in order to avoid the risks associated with terrain flight especially small arm and machine gun and rocket-propelled grenade (RPG) threat. However, some pilots still insist on conducting terrain flight even though they are aware of its dangers. Degraded lift and maneuver capability compelled army aviation to change the roles of aircraft.

Source: Created by author.

Table 22. Training	
Changes on Training	Consequences
Environmental flight trainings High-altitude flight training High-Altitude Army National Guard Aviation Training Site (HAATS) High-Altitude Mountain Environmental Training Strategy (HAMETS) Desert Operations	During OEF, high altitude training became a requirement for all aircrew prior to deployment. HAATS and HAMETS training programs significantly helped army aviation to train pilots and aircrews on power management at high altitudes. However, unfortunately the number of the pilots who were trained in HAATS increased gradually due to resource and capacity limitations. U.S. Army Aviation still has this problem. Additionally, HAMETS trainings may not be as beneficial as HAATS to a unit due to the absence of similar high altitude mountains at a unit's home station. Unlike high altitude operations, desert operations were not given enough importance. Army aviation did not create any institution or formal courses specific to flight in desert conditions. The only training available was informal and was conducted by senior pilots who passed on their experience operating in the desert during previous deployments.
Night vision goggles (NVG) flight training Familiarization and qualification training on new aircraft and equipment such as aircraft survivability equipment (ASE) and aviation life support equipment (ALSE)	Several courses were given to aviators during OEF. These trainings helped pilots and aircrews operate effectively and safely.
Flight school curriculum was changed	The flight school curriculum was previously concentrated on conventional warfare and technological superiority. During OEF, it was updated to address to the high altitude, desert and urban environment in Afghanistan.

Source: Created by author.

Table 23. Equipment	
Changes on Equipment	Consequences
Platforms were upgraded	Four different types of rotary-wing platforms; AH-64 Apache, CH-47 Chinook, UH-60 Blackhawk and OH-58 Kiowa; were used in Afghanistan during OEF. Since the harsh OE of Afghanistan adversely affected their performance, only CH-47 Chinook could provide enough power for aviators when needed. These platforms were upgraded to higher models several times to meet the requirements of the OE of Afghanistan. However, none of the aircraft upgraded could not solve the power problem.
RAH-66 Comanche Armed Reconnaissance Program was cancelled	After two decades of effort and investment, RAH-66 Comanche program cancelled because of budget constraints, changing threat environment, and the evolving nature of future requirements. After the cancellation, the money ($39 billion dollars) which had been allocated for this program was used for other aviation programs such as upgrading the other aircraft and acquiring more helicopters.

Source: Created by author.

Recommendations

Recommendations to U.S. Army Aviation

1. HAATS training contributed tremendously to OEF aircrews' confidence to operate helicopters appropriately and safely at maximum gross weights in mountainous environment of Afghanistan. Today, HAATS continues to train over 400 aircrews from multiple countries and all services annually. However, its capacity is limited to approximately twelve pilots and six helicopters at a time. Because of the inadequate

training capacity and high demand of international and joint services for the course, only a small percentage of U.S. Army Aviation pilots and crews continue to have the opportunity to attend HAATS. It is imperative for U.S. Army Aviation to expand the capacity of the HAATS to train all aircrews periodically.

2. One of the biggest challenges in Afghanistan was overcoming an aircraft's lack of performance. Army aviation tried to compensate for this deficiency by assigning certain types of aircraft to regions where they could operate based upon their performance capabilities. Additionally, aircraft were modified several times in order to increase their power and maneuverability during OEF. Despite these efforts, aircraft other than CH-47 Chinooks did not gain required capability to operate in an OE like Afghanistan. U.S. Army Aviation should upgrade current aircraft to more powerful models or acquire more capable aircraft in long term to operate in similar environments.

3. BAEs remedied the AGI and coordination problem between army aviation units and ground maneuver forces. However, the number of the personnel assigned to BAE significantly decreased over time. In addition, according to Joint Readiness Training Center (JRTC) Observers Hodges's and Dohogn's article, most of the aviators serving in BAEs today are not well-trained and experienced. It is important for U.S. Army Aviation to man, train, and equip BAEs to maintain healthy AGI and coordination with supported ground forces.

Recommendations to Further Researchers

1. The survey participants were randomly selected from faculty or student officers in the rank of captain to colonel and who are currently assigned to Command and General Staff Officer Course (CGSOC) in Fort Leavenworth, Kansas. The demographics are

expected to be in line with those seen Army-wide with respect to age, gender and racial demographics of mainly field grade officers. However, this survey only reflects the thought of a group of officers instead of the entire army aviation community. Should a more comprehensive survey be completed with a larger group of aviators, comprised of officers, non-commissioned officers (NCO), and warrant officers, the results would be more reliable.

2. This research, which is limited to Afghanistan, does not address Operation Iraqi Freedom or other operations conducted at the same time or under the name of OEF in other areas such as the Philippines and Horn of Africa. Therefore, it is impossible to state that OEF was the only factor which shaped the adaptation of U.S. Army Aviation during this period. Further research on those OEs and their effects on army aviation operations may help to better elucidate the overall evolution of U.S. Army Aviation.

3. This study is limited to the changes done by U.S. Army Aviation during OEF. However, the roots of some of these changes may reach to the pre-OEF period which also includes Operation Desert Shield/Storm. A further research on the influence of the pre-OEF period on the changes done during OEF would help to understand the evolution better.

4. In this study, only U.S. Army Aviation is taken into consideration. U.S. Air Force, Navy, Marine, and Special Operations Forces air assets are not discussed. A further study which investigates the sister services' and Special Operations Forces' aviation assets and their experiences in Afghanistan may assist U.S. Army Aviation to plan the future role of army aviation on the battlefield.

5. This study which focuses primarily on organization, doctrine, training and equipment does not address logistics. It was clearly understood in this study that the harsh OE of Afghanistan had enormous effects on the logistical activities of U.S. Army Aviation. A separate study focused on logistics may help further illuminate the adaptation of U.S. Army Aviation during OEF.

Conclusions

The operational environment (OE) in Afghanistan, which consisted of both high-altitude mountainous and desert terrain structures, was significantly different than the other conditions in which U.S. Army Aviation fought before. The harsh OE in Afghanistan adversely effected the capabilities and effectiveness of both aircraft and aircrew. During OEF, the major challenges for aviators were limited aircraft lift and maneuver capability and degraded attack helicopter support capability.

U.S. Army Aviation implemented drastic changes in terms of doctrine, organization, training, and equipment in response to these effects of the OE in Afghanistan. First and foremost, U.S. Army Aviation abandoned Air Land Battle doctrine and changed its focus from deep operations to close combat operations. Over time, the primary mission of army aviation units changed to support ground maneuver forces in the close fight. Army Aviation also created several mechanisms to meet the needs of AGI and coordination. In parallel with this mentality shift, U.S. Army Aviation units transformed into a smaller, modular, adaptable, agile, deployable and logistically sustainable structure which could conduct full spectrum operations.

The threat in the future is expected to be similar to the current hybrid threat. Focusing on a singular threat, either conventional or irregular, is not an acceptable option

for U.S. Army Aviation. To be successful in the future's OE, it needs to maintain the capabilities it gained during OEF to address both threats. On the other hand, U.S. Army Aviation needs to transform the current temporary form especially MATFs into permanent structures which would allow army aviation units to operate in different OEs.

GLOSSARY

Belly-landing. Occurs when an aircraft lands without its landing gear fully extended and uses its underside, or belly, as its primary landing device.

Brownout. An in-flight visibility restriction due to dust or sand in the air.

Conflict Episodes. An armed struggle or class between organized groups within a nation or between nations, in order to achieve limited political or military objectives during certain periods.[109]

Effective Translational Lift. Effective Translational Lift occurs with the helicopter at about 16 to 24 knots, when the rotor—depending on size, blade area, and RPM of the rotor system—completely outruns the recirculation of old vortexes and begins to work in relatively undisturbed air. The rotor no longer pumps the air in a circular pattern but continually flies into undisturbed air. The flow of air through the rotor system is more horizontal, therefore induced flow and induced drag are reduced. The angle of attack is subsequently increased, which makes the rotor system operate more efficiently. This increased efficiency continues with increased airspeed until the best climb airspeed is reached, when total drag is at its' lowest point. Greater airspeeds result in lower efficiency due to increased parasite drag.[110]

In Ground Effect. Rotor efficiency is increased by ground effect to a height of about one rotor diameter (measured from the ground to the rotor disk) for most helicopters. This increase in angle of attack requires a reduced blade pitch angle. This reduces the power required to hover in ground effect.[111]

Out Ground Effect. The benefit of placing the helicopter near the ground is lost above in ground effect altitude. Above this altitude, the power required to hover remains nearly constant, given similar conditions (such as wind).[112]

Physiological Deficient Zone. Zone of the atmosphere ranges from 10,000 feet at its base to 50,000 feet at its highest point.

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[109] Department of the Army, Field Manual (FM) 1-02, *Operational Terms and Graphics* (Washington, DC: Department of the Army, 2004), 1-43.

[110] Department of the Army, FM 3-04.203, *Fundamentals of Flight,* 1-45.

[111] Ibid.*,* 1-36.

[112] Ibid., 1-37.

Physiological Efficient Zone. Zone of the atmosphere extend upward from sea level to 10,000 feet.

Rotor-wash. Air driven downwards by the main rotor of the helicopter as it turns (the equivalent for fixed-wing aircraft is downwash).

Running Fire. An engagement from a moving helicopter above effective translational lift (ETL). Forward airspeed adds stability to the helicopter and increases the delivery accuracy of weapon systems, particularly rockets.[113]

White-out. A weather condition that causes disorientation and low visibility by snow, overcast clouds and fog.

[113] Department of the Army, FM 3-04.126, *Attack Reconnaissance Helicopter Operations*, 3-69.

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